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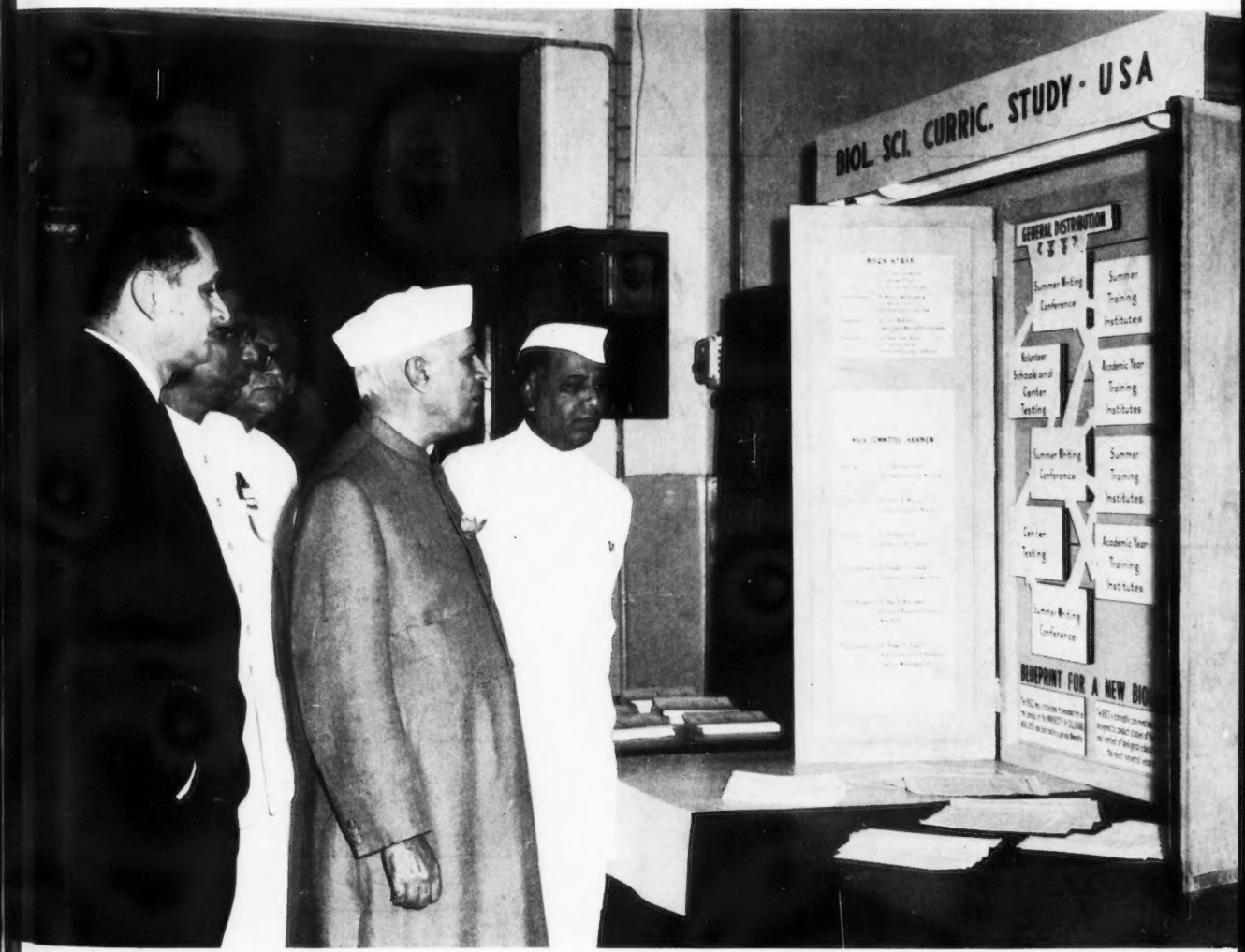

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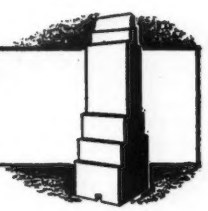

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Cover Picture: Dr. Arnold B. Grobman, Director of AIBS Biological Sciences Curriculum Study, described the BSCS to India's Prime Minister Jawaharlal Nehru and Mr. Y. B. Chavan, Chief Minister of Bombay State, at the "All India Science Congress," in January.

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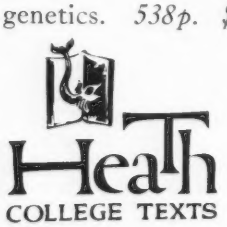

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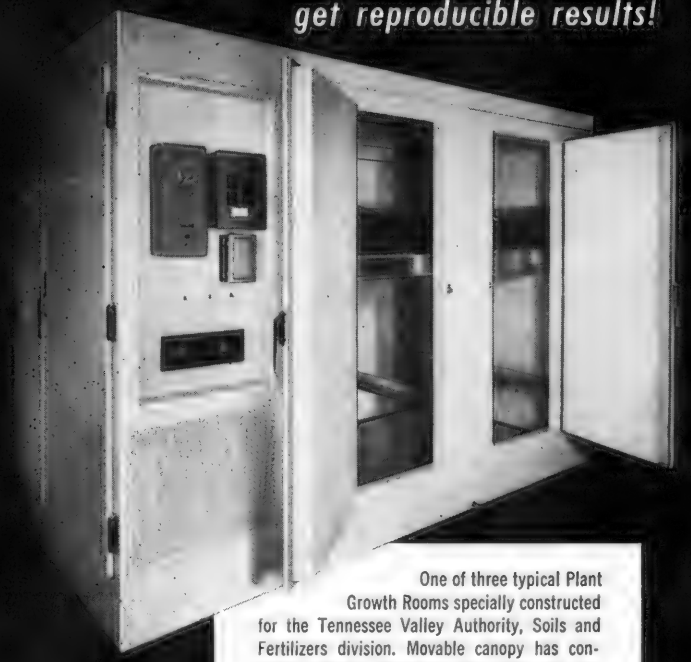

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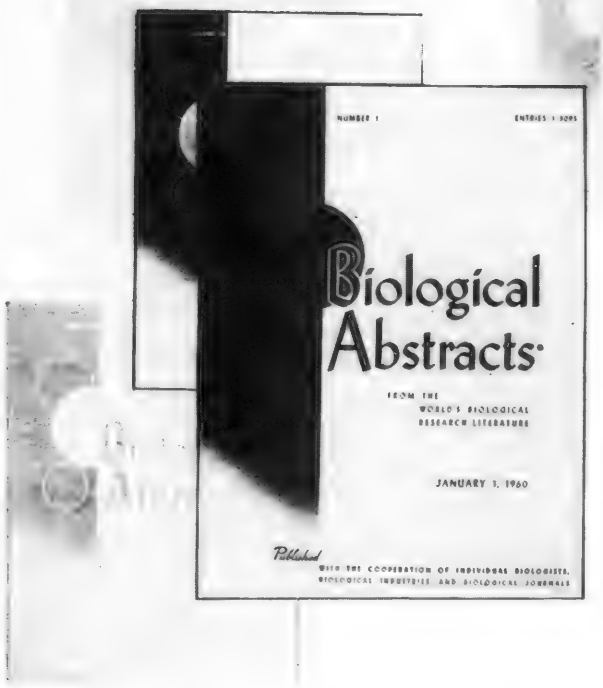

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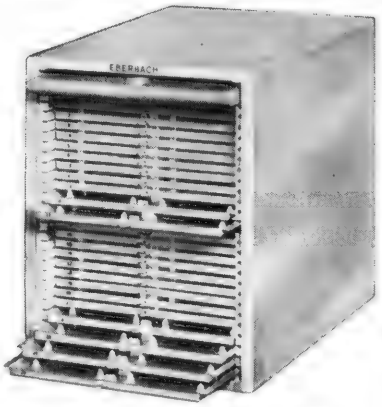

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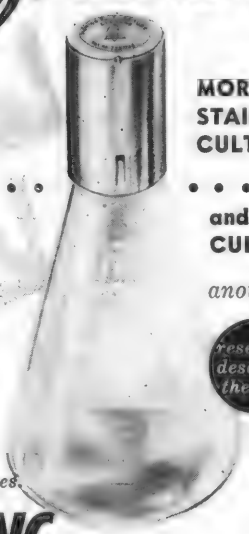

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Some relief is sought for biologists who find themselves inundated with journals

Fred R. Cagle

Research Coordinator, Tulane University, New Orleans, Louisiana

Increase of Biological Serials—A Destructive Trend?

NEW SERIALS in biology are started each month; the rate of increase has accelerated during the last five years. Of 202 biologists queried in 1957, 24 listed 26 new serials being planned in the United States. Estimates of the number of biological serials (15,000-25,000) clearly indicate that biological information is distributed in more publications than is any other segment of man's knowledge. Also, the number of papers printed annually is increasing.

This tidal wave of publication has seriously handicapped biology. The major results include: narrowing of special fields; decrease in number of review articles; failure of the scientist to be cognizant of broad implications of his science; dangerous dependence on media of secondary publication; reduction in rate of development of major generalizations; provincialism in research; inhibition of growth of new centers of research; superfluous duplication of creative work; the waste of minds that our society cannot afford; the discouragement of young researchers; and, the imposition of routine editorial tasks on scientists. Duplication of research and repetitious publication contributes to further expansion of the literature.

Too, the flood presents a maze of library problems and forces the biologist to expend an excessive part of his income for journal subscriptions and development of his personal library.

The Fields Narrow as the Journals Increase

The biologist restricting his library research to serials in his own specialty can but rarely locate and read the majority of pertinent papers. Responses (213) to a questionnaire provided the following information on reading habits: number of serials read regularly, 2 to 200, average 13; number of serials read occasionally, 1 to 300, average 26.8; number of serials checked for contents only, 2 to 500, average 46.8.

In response to a request to indicate major difficulties in library research 42 biologists stressed identification of pertinent literature; 52, location of literature; 63, procurement. In supplementary comments 26 persons stressed that time was the major problem. Many stressed that translation, especially of Russian literature, was a serious obstacle.

The researcher is usually compelled to restrict his serious reading to a small group of serials. To him, these journals are his field. Although Dr. Ralph Shaw has stated (report to New Orleans Editors' Conference) that in any field of science 75% to 90% of useful material is found in from 50 to 75 journals, few biologists should restrict their library research to this extent—should not, but must do so because of time.

What are the factors influencing the continuing increase in publication? A few are evident—professional progress based on research production, more money for research, more new knowledge produced, and more biologists at work. We do not wish to change these factors; each is important to the continued growth of biology.

What Factors Can We Change?

Are there, however, contributing factors that may be modified? Such influences as these: the publication of new serials as an exchange medium; the publication of new serials to provide outlets for material not acceptable by existing serials; demand of specialists for the concentration of research into a single serial to reduce the task of library research; the initiation of new serials for "prestige." Each of these are pressures that increase the number of serials, and as the number of serials increases each of these pressures becomes greater. This cycle is essentially destructive to the biological sciences.

Exchange!

Few institutions can build a research library in biology if they do not have a biological publication to exchange. The leading serial libraries in zoology are dependent on exchange. More than two-thirds of the serials received by the library of the Philadelphia Academy of Science are exchanged; the serial library

of the Museum of Comparative Zoology, Harvard, is dependent on exchange agreements; the Meade Natural History Library, Tulane University, receives more than 800 biological serials in exchange. Many of the foreign serials cannot be readily purchased and few publishers routinely furnish notices of publication. Exchange is the only practical method of obtaining many serials. Thus a never-ending cycle: publications are started for use as exchange for publications started for use as exchange. Today, the institution desiring an outstanding serial library must have a publication or such large prestige that other institutions do not expect exchange. The tendency for librarians to desire exchange of equivalent numbers of pages exerts a constant pressure on exchanging institutions to increase the size of their publication.

The desire to exchange an equivalent number of pages rather than serial for serial may well be used as a basis for reducing the number of serials. Thus, the museums of North America publish many journals. If exchange were eliminated as one of the primary reasons for publication, perhaps the serials could be consolidated into a single museum journal with each museum sharing its proportionate cost. This would increase efficiency of publication and greatly simplify the bibliographic chore. A central exchange agency could arrange to exchange this cooperatively published serial for several foreign museum serials to be distributed to the contributing museums.

Similarly, the publication of many of the university sponsored serials and the state academy publications could be consolidated and exchanged as a unit with many gains for the publishers and the scientist-consumer.

Not Enough Outlets?

The problems of the author in gaining publication have contributed to the pressures for new serials. The rejection of papers because of the nature of their subject matter has led to the splintering of organizations and the subsequent appearance of new serials to provide additional outlets. The general feeling of biologists is that adequate outlets are now available for the publication of new information. Only 35 of 213 biologists queried stated that original research was unpublished because of lack of publication outlet. Categories in which difficulty was reported were; systematics, ecology, anatomy, statistics. Emphasis in each field was placed on the absence of outlets for long papers and monographs.

The scattering of papers in a special field in many serials has often led to the establishment of a new journal, not because of the need for a new outlet but to bring about a concentration of the current knowledge for the convenience of researchers.

The increasing mass of literature in the biological sciences demands that the following be achieved:

1. An improvement in the quality of science writing.
2. The consolidation of existing serials.
3. The inhibition of publication of new serials.
4. The establishment of cooperative agreements to gain efficiency in editing and publishing.
5. The use of new media for primary publication (microforms, newspaper).
6. The establishment of central bibliographic services for biologists.
7. A rapid increase in the production of science literature specialists.
8. The provision in research budgets for the employment of literature research specialists.

There can be improvement in the quality of science writing in biology. Urgently required is a textbook specifically directed toward writing problems for technical journals. We do not need additional "guides in the preparation of manuscripts." The availability of a textbook would encourage the development of writing courses in graduate programs. A second step in the improvement of writing is the elimination of overloaded, volunteer editors who can but rarely demand high quality of conciseness and clarity in manuscripts.

To Consolidate

The rapid proliferation of biological serials in North America obviously demands the consideration of actions directed toward consolidation of serials. A sample of 1017 biological serials indicates that 50% concern basic biology; 30%, applied biology; and 20%, semipopular material. A sample of 856 serials indicates that 44% are published by societies, 22% by institutions, 28% by government agencies, and 6% by business concerns. Why not a single journal for the museums? Why not a single journal for the universities? Why not a single journal for government? The consolidation of journals from each of these three sources (50% of our serials) could improve editing, lower costs, increase outlets, provide greater flexibility and, perhaps of greater importance, simplify the library research of the investigator. An associated reduction in the cost of library operation would not be insignificant.

Or Not to Consolidate

The major objections to the consolidation of such serials will be supposed loss of prestige publications to individual institutions and loss of exchange materials. But proper planning will prevent either of these losses. Another serious objection will come from the ultraspecialist who desires to receive and read only information in his own research area. Yet one of our major handicaps in biological progress is the failure of the specialist to be aware of pertinent knowledge in related fields. The physiologist is often ignorant of significant data in systematics, ethology, morphology or ecology; the systematist, morphologist, ethologist or ecologist is often unaware of the contributions of the physiologist, and the result is a continuing decline in the synthesis of biological knowledge. The establishment of consolidated serials would do much to correct this fragmentation of biology.

Consolidation of serials will provide the basis for improvement in indexing, abstracting and automatic retrieval services and will establish a basis for the wise utilization of new forms of publication.

Basic interrelationships of biological elements suggest specific recommendations

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A Curricular "Straw Man" for Biologists

FOR SEVERAL decades biology has been the "sick man" of science. Despite the constant flow of important new information from the research laboratories, biology has steadily lost prestige among the public to the, apparently, more dynamic and romantic fields of chemistry and physics. Consequently, biology has often failed to attract the best undergraduate talent. Lack of positive achievement can hardly be blamed for this situation. The significant advances that have recently been made in our understanding of the organization and function of every biological unit from molecules to populations emphasize this point. As Glass (1957) has pointed out, we need not make apologies for being biologists. He writes that "to be a biologist is to seek for the uttermost of nature's secrets, the nature of life itself. We live, and in that kinship of life with plants and animals and microbes strive to comprehend what it is that sets us apart from the infinite uncomprehending universe." Taylor (1958) in a very penetrating article tells us that "the objectives of the biologist's inquiry is (sic) the hottest thing in the universe." If our achievements and our aims have been worthy, in what essential way has biology failed to maintain its proper status among the sciences?

Many biologists feel that the major failure has been in communication. Glass (1957) says: "There are few biologists who endeavor to make their biology count for anything outside the laboratory and the classroom." If this statement is true, is it because we have not made our biology in the classroom count for enough? It is reasonably certain that we have not. As Behnke (1957) indicates, our curricula in biology have remained static despite the accretion of new "fringe" courses and the occasional fragmentation of older, traditional courses. The lag period between classroom biology and the research frontiers has been appalling.

Three Weaknesses

Although many complex factors are involved, it seems to us that three specific weaknesses of the general biology program for undergraduates should be pointed out. First, biology has achieved a reputation among students as the easy science. An unqualified person or one too lazy to accept the rigors of chemistry, mathematics, or physics can always drift into biology to fulfill science requirements or even to prepare for a professional career. There is little wonder that students should feel this way when many biologists themselves maintain that courses in biology should not be made too demanding lest they drive away possible future biologists. There is also a feeling that one function of biology is to present a science program on the campus that every liberal arts candidate can handle. Secondly, and perhaps to a less debilitating degree, the biology curriculum in many institutions has been set up as a service program for the premedical student. Despite the fact that many medical schools openly deplore such a situation, biology curricula continue to emphasize vertebrate zoology with a touch of pathogenic bacteriology and physiological hygiene thrown in for good measure. Thirdly, and most important of all, there has been a general failure to tear down the traditional fields of biology and to resynthesize them according to newly developed conceptional templates. Thus we have an awesome array of biological bailiwicks. To maintain them, the most aggressive sort of territorial behavior is often in evidence.

Further shaping of the biology curriculum has been to some extent hampered by highly competent biologists who, following the "bag of enzymes" approach to the living system, have felt that most living processes can be adequately interpreted in terms of chemistry and physics. To the argument that biology is only a peripheral area the formulations of which must rely on the more exact physical sciences, Wald (1958) says that: "If biology is ever reduced to chemistry and physics, it will only be because the latter have grown up to biology. At that point it will be hard to say which is which." Such an amalgamation of the sciences is a strong possibility, but when it does occur, biology will have made contributions to our understanding of the universe equal to those of her sister sciences. For the

present, however, biology remains discrete and, because of the very nature of the problems it seeks to solve, must be approached in ways that are often unique.

Interrelationships

Recently a number of leading biologists have directed attention to conceptional schemes which redefine biology as a discrete discipline in terms of its basic units and the organizational relationship of these units. According to Gerard (1957) we are able to recognize systems (orgs) which possess individuality and which can be arranged at different levels or hierarchies according to the complexity of the integration of their constituent parts. Hence biology, which deals with systems of a very high level of variability and complexity, is superordinate to the chemical and physical sciences. Within the scope of biological phenomena one can arrange a hierarchy of systems proceeding from the organization of molecular units to the individuation of populations and ecosystems. At each level, interpretations are based on our knowledge of the becoming (history), behaving (regulation) and being (organization) of the individual systems. In Gerard's words: "Becoming gives being, and this is capable of behaving; order is produced and maintained." Waddington (1957) has recently added to the conceptualization of the life process. He stresses, as does Gerard, the integrative aspects of living systems and tells us that this wholeness "is almost an aesthetic quality—a character of self-sufficiency and completeness." In addition, living things have a form and end; directiveness produces end results. Essential to our understanding of the living creature or population is the recognition of three elements of time: largest scale (evolution); medium scale (development and life history); shortest scale (metabolism and maintenance). The first two scales are roughly equivalent to the "becoming" of Gerard's scheme, while the shortest represents the "behaving." It is obvious that the above concepts serve to define areas within biology, but in stressing the interrelationships of all elements they have rendered the classical fields of biology quite obsolete.

Toward Better Curricula

Finally, we might well direct attention to the very fine work that has been accomplished in recent years by many organizations which have sought to direct the development of biological curricula, to aid the recruitment of good students into professional biology and to increase the effectiveness of communication between biology and the public mind. Among the most significant of these programs have been the symposium on "Education and the Future of Biology" conducted at the AIBS meetings in 1955 at the University of Connecticut; the preparation of the pamphlet "Careers in Biology" by the Subcommittee on Education of the American Society of Zoologists; and the massive report "Recommendations on Undergraduate Curricula in the Biological Sciences" produced by a conference held under the auspices of the Committee on Educational Policies of the National Academy of Sciences, National Research Council.

It would seem, then, that the formulation of new unifying concepts in biology, the work of various organizations in reviewing curricula, and the continual broadening of horizons through basic research, indicate that the "sick man" is facing a favorable prognosis, and perhaps complete recovery. However, we feel that an additional effort must be made to translate the major features of these encouraging developments into positive action at the level of the undergraduate curriculum. Indeed, the Conference on Undergraduate Curricula in the Biological Sciences has recommended "widespread, continuing and concentrated effort by biologists to re-examine college programs and seek ways to improve them." One way of exerting this effort effectively is to present curriculum plans which are more specific in content than are the necessarily diffuse recommendations of large committees.

Suggestions to Consider

Although it is unrealistic to expect that any single proposed curriculum will approach perfection, or will even be practicable in all undergraduate colleges, it is hoped that each proposal will cause a ferment of thought and criticism which will stimulate innovations in the curricula of individual departments. We therefore emphasize that the curriculum suggested in the following section is intended as a "straw man" to stimulate discussion. We feel, however, that the type of approach inherent in the curriculum would lead to a more integrated, stimulating concept of biology than that often resulting from more "classical" approaches. We further feel that the proposal leads to no loss of rigor and is more in line with modern trends of research.

The objectives considered in drawing up the following proposal are based on the developments outlined above.

1. Inclusion of a core of courses which provide a common background for all undergraduates majoring in biology, regardless of the postgraduate careers planned.
2. Formulation of a program which will not only provide solid training in classical biology but will also keep pace with research developments.
3. Inclusion of the new, broad concepts of biological systems as progressing in a sequential manner from the simpler to the most complex types of integration.
4. Development of one-year courses which embody the above concepts and which cross the barriers between the classical disciplines.

In formulating this "straw man" the authors have considered with care the proposals of the Committee on Undergraduate Curricula. Our program incorporates many of the features of the programs proposed by the Committee, but is somewhat broader in scope. We further wish to emphasize that although the curriculum outlined below is not in effect at our respective institutions, both authors belong to departments which continually review their undergraduate programs with a view to increasing their effectiveness. Such review should be, but frequently is not, an inherent part of departmental activity.

The Proposed Program

In the following list, the number (1) or (2) following the name of a course denotes its suggested length in semesters or terms. Each subject is listed under the year during which it would normally be taken by students excused from the introductory course; if it would be taken during a different year by students not so excused, the year is designated by the numerals (I), (II), etc. following the name of the course.

Year I

Principles and Consequences of Development (2; II)
Inorganic Chemistry and Qualitative Analysis (2; II)
Introductory Mathematics and Statistics (2)
Introductory Biology (2)

Year II

Experimental Morphogenesis, Animal, *or*
Experimental Studies of Life Cycles and Lower Plants (1)
Physics (2)
Organic Chemistry and Principles of Quantitative Analysis (2; III)

Year III

Cellular Biology and Coordinative Mechanisms (2)
Research in Biology (1 or 2)

Year IV

Principles of Population Dynamics (2)
(3)
Mechanisms of Evolution (1)
Research in Biology (1 or 2)

Additional Projects

1. Students excused from the introductory course would learn classification outside of scheduled classes. Texts would be assigned and a room set up with demonstrations and visual aids; an examination would be given during the second month of Year I and would be repeated at the end of the first semester of Year IV. Classification would be given as part of the laboratory schedule of Introductory Biology, but majors recruited from this course would take the Year IV examination.

2. An independent reading program, additional to course work and covered on the comprehensive examination, would be required during Year III and Year IV. Each major would be interviewed periodically on the progress of his reading.

In the above curriculum all courses, with the possible exception of the two "problems" courses, are regarded as comprising a "core" to be taken by all majors excused from the introductory course. Recruits from the introductory course would take the same core with the exception of the Year II alternatives. Additional electives would be chosen by individual departments, and are beyond the scope of this proposal. The inclusion of an extensive core is defended on the grounds that it provides a fund of knowledge that may be useful background for any specialization the student selects in graduate or professional school. In all subfields of biology there is a need for people capable of integrating concepts in their research and appreciating the applicability of results obtained by others. These qualities are not likely to be acquired if a man has wide gaps in his training. For example, who can say that a man working on problems of conservation will not need to use concepts drawn from physiology, biochemistry, or genetics in his studies!

The rigor of the program is certainly no greater than that imposed by departments of physics and chemistry, and surely students embarking on careers which depend on biological sciences need as sound a basic grounding as do students whose careers will be in the physical sciences. That many future scientists do not now receive highly rigorous and selective training is a condemnation of undergraduate programs at some institutions. No provision is made or intended for the "gentleman major." The fact that this program would possibly require that distributive requirements, in effect in most colleges, be satisfied over a four-year rather than a two-year span, is also here considered an advantage. Should the broadening of intellectual horizons necessarily end by the third year of college?

A few thoughts concerning possible general organizations of certain of the subjects may be in order; however, no attempt will be made here to prescribe in detail the material to be included in each of the proposed courses. The following suggestions are offered:

1. The introductory course would be taken only by (a) students not planning to enter a biology major and (b) prospective majors who have not had secondary school biology or have failed a proficiency examination required of those who have had secondary school biology. (The proficiency examination might also be used as a basis for exemption from the course of qualified students not planning a biology major.) The course would be topical, of the "block-gap" type now being given successfully in many colleges, and would be staffed by several members of the department, each giving the section dealing with his own specialty. Surveys of the plant and animal kingdoms, with no attempt at comprehensiveness, would be introduced in laboratory only, with the help of information in texts and mimeographs. Quantitative aspects of modern biology would be emphasized in both lectures and laboratories. One frank and open purpose of the course would be to "recruit" the most able students into a biology major.

2. The course on *Principles and Consequences of Development* should present as far as is possible the concepts of morphogenesis and differentiation in terms of general and comparative principles. Structural characteristics of mature organisms could be presented as consequences of developmental processes; principles and illustrations should be drawn from plant material and from the invertebrates, as well as from the vertebrates. We feel that to focus attention only on vertebrate embryology and anatomy is to ignore concepts of basic and general applicability. The broader scope suggested here could be provided without depriving pre-medical students of an adequate basis for professional study, and would certainly broaden the students' outlooks.

3. The alternative courses in *Experimental Morphogenesis* or *Life Cycles* and *Lower Plants* would be a

"bonus" for students excused from the introductory course; it is doubtful that students not so excused would have time to fit either course into their schedules. Each student would choose between the alternatives on the basis of interest; at no other point in the curriculum does a clear distinction between plant and animal material seem necessary or desirable. The course is considered a low-level research program, probably including some physiology, genetics, etc., although primary emphasis would be placed on such topics as tissue transplants, regeneration, and the comparative roles of different stages in the life cycles of plants.

4. *Cellular Metabolism and Coordinative Mechanisms* would include intermediary metabolism, photosynthesis, and such other topics in physiology as may seem appropriate. Information derived from biochemistry and biophysics should be thoroughly integrated into the course, and reasonable emphasis should be placed on the microorganisms. We suggest that it would be appropriate to include the theories of the structure of genes and chromosomes, viruses, and viral duplication, as well as a discussion of gene action and chemical genetics.

5. The course entitled *Principles of Population Dynamics* would include appropriate material on community ecology, speciation, and other topics selected by the instructor in charge. It would also include most of the material usually reserved for courses in genetics. With gene structure and action previously considered, segregation genetics, chromosomal aberrations, population genetics and similar topics can be unified and directed within the context of evolution and population structure.

6. The *Research* courses would of course be designed to consist of individual or small-group research problems, increasing in difficulty and breadth of scope. The object would be to develop the students' originality, independence, and interest. The course in *Mechanisms of Evolution* should be of the seminar type, drawing together information from diverse branches of science and relating them to one great concept. Students in this course should be expected to lead their discussions with a minimum of staff assistance, and to gain information from advanced texts and research reports.

7. The independent reading program, now in operation in some colleges, is an excellent way of integrating areas and views covered in formal courses and of showing interrelations between biology and other branches of science. It can introduce philosophical concepts related to science and research. And, above all, it can be enjoyable! The seminar discussion appears to be a rewarding way of reviewing the reading and checking that the students have completed it as asked.

Finally, it is recognized that any program such as that outlined above requires that considerable attention be given to individual students. This means that many staffs would have to be increased—a reasonable expectation if departments agree that such an increase would result in distinct educational advantages. At present, the student-teacher ratio in biology departments of many schools is higher than in nonscience departments, and the teaching load of the staff is correspondingly heavier. This situation is conducive neither to research nor to curricular experimentation in such departments. It would be expected that many of the courses would be handled by a staff, rather than by a single teacher.

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Russian Biological Journal Translations

The AIBS is currently translating and publishing seven Russian research journals in biology. These journals are translated with support from the National Science Foundation, which is eager that such information be more widely distributed to biologists throughout the world. It is hoped that this material will aid biologists in research, prevent duplication of work, give some idea of what is being done by Soviet scientists in the field of biology, and also bring about a better international understanding among scientists.

For information, write the

AIBS Publications Office, 2000 P Street, N.W., Washington 6, D.C.

An AIBS Hydrobiology Committee Panel considers the world-wide shark hazard problem

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The Shark Research Panel

FROM April 8 to 11, 1958, the AIBS, in conjunction with Tulane University, sponsored a conference on Basic Research Approaches to the Development of Shark Repellents. At this conference, supported by the Navy Department through the Office of Naval Research, a broad scientific program was formulated which would deal with the shark hazard problem, and a series of recommendations was subsequently published in the AIBS Bulletin (Vol. 8, No. 3, pp. 17-19). It was the conviction of those who prepared the recommendations that basic studies dealing with the taxonomy, behavior, and the functional anatomy of sharks was essential to an understanding of the shark hazard problem and that research on sharks both at home and abroad should be encouraged and coordinated. To expedite and activate the recommendations drawn up at New Orleans and to serve as a clearing house for all information related to the field of elasmobranch biology in general, and the shark hazard problem in particular, the AIBS Shark Research Panel, composed of Leonard P. Schultz, Stewart Springer, and Perry W. Gilbert, Chairman, was established on June 25, 1958. Subsequently, on December 7, 1958, the Shark Research Panel became affiliated with the AIBS Hydrobiology Committee and now functions as a panel of that committee.

Broadly speaking, the Shark Research Panel is concerned with all aspects of the biology of elasmobranch fishes. To its bi-monthly meetings, usually in Washington, D. C., one or more consultants from at home or abroad are invited. During the calendar year 1959, the Panel has initiated, or has served in an advisory capacity to, the following projects:

1. *Preparation of the AIBS Shark Volume*

This volume is an outgrowth of several of the papers presented at the New Orleans shark conference. In addition, to supplement papers presented at New Orleans, several invited papers have been added and a substantial volume is now taking shape which will deal with certain aspects of the biology and natural history of sharks in general and with recognized species which are considered dangerous to man in particular. Included in the volume are sections dealing with the taxonomy, behavior, nervous system, and sense organs of sharks. Dangerous sharks will be discussed by geographical region and a general review of patterns of shark attack has been prepared. In addition, a section will be devoted to anti-shark measures now in operation in various parts of the world and an appendix will include a comprehensive tabulation of shark attacks, and recommended precautions for swimmers and divers who frequent shark-infested waters.

2. *Maintenance of Shark-Attack File for the World*

At present the Shark Research Panel receives clippings from five different clipping services concerning shark incidents. When an attack occurs anywhere in the world a physician or scientist in the area is immediately contacted and his assistance in securing documentation on the attack is solicited. A two-page form requesting information concerning location of attack, environmental conditions, kind of shark, nature and treatment of wounds, type of activity the victim was indulging in at the time of the attack, etc., has been prepared for the convenience of those who collaborate in supplying documentation. From reliable documentation of this type we hope it will be possible to learn more about the environment conditions, and behavior patterns and activities of swimmers which provoke a shark to attack. The Shark-Attack File, suitably cross-indexed, is housed in the Division of Fishes, Smithsonian Institution, Washington, D. C. A duplicate working file is maintained by the chairman of the Shark Research Panel at Cornell University.

3. *Annual List of Shark Attacks*

In January of each year a list will be prepared of all shark attacks which have occurred anywhere in the world during the previous calendar year. Appended to this list will be a brief analysis of the nature of

the attacks and the environmental conditions which prevailed in the area at the time of the attack. The list of shark attacks for 1959 is now nearly complete and will soon be ready for publication.

4. *Basic Research*

Fifteen scientists stationed in Australia, the central Pacific, the United States, Canada, the Caribbean Area, England, and South Africa, are now actively investigating the migration of sharks, the taxonomy of Pacific sharks, and the anatomy and physiology of shark sense organs. Others are analyzing patterns of shark attack, and the orientation and behavior of sharks under both laboratory and field conditions. Some investigators are working experimentally with small species of sharks while others are working with relatively large and dangerous species. Several rather surprising differences in the behavior pattern, anatomy, and physiology of the several species of sharks studied have already become apparent.

5. *Applied Research*

The Shark Research Panel is appraising the effectiveness of various anti-shark measures such as meshing, shocking, and the use of chemical and physical repellents, now in operation throughout the world. The panel, in collaboration with its consultants, has developed rigorous methods for testing chemical and physical agents for feeding-inhibition and repellent properties and has taken part in several testing programs in both Pacific and Caribbean waters. Further tests are planned for 1960 in which various chemicals and biological products, as well as low frequency sounds, will be employed under both controlled laboratory and field conditions on several species of sharks.

6. *Service*

During the past year members of the Shark Research Panel have served in an advisory capacity to the Office of Naval Research and to other government agencies. In addition, the panel has prepared a brochure outlining precautionary measures for civilians and service personnel who frequent shark-infested waters.

The Shark Research Panel stands ready, at all times, to advise and assist serious investigators who wish to pursue work in any of the areas outlined above, or in related areas which will improve our understanding of the shark hazard problem, or add to our knowledge of the basic biology of that highly successful group to which sharks belong—the elasmobranch fishes.

Frontiers of Science

The AIBS will participate this year as a co-sponsor of an exciting program for young people—the annual Symposium of the Frontiers of Science Foundation of Oklahoma.

The topic will be "Origins of Life." The program topic and participants were chosen at a conference arranged by Dr. Barry Commoner at Washington University, St. Louis, Missouri. The AIBS–Frontiers of Science Committee has completed a selection of topics to be presented to 6,000 Southwestern high school students in Oklahoma City early in April. Planning began with a meeting of AIBS headquarters staff and Dr. James Harlow, Executive Director of the Frontiers of Science Foundation, in Washington, and continued during a visit to Oklahoma City by Harold F. Osborne, Biology News Bureau Director.

An International Ecological Year?

Two proposals for broad, well-supported, intensive programs of biological study and research came out of the summarizing session of a Conference on Biological Control of Insects of Medical Importance, held in Washington on February 3 and 4. Sixty-five military, agricultural and public health scientists attended. Dr. John R. Olive, Assistant Executive Director of the AIBS, suggested an "International Ecological Year" to call attention to needs for new research in the areas of taxonomy and ecology.

Dr. Roger Reid, Office of Naval Research, proposed that an "International Biological Decade" be organized to concentrate attention on filling gaps in biological knowledge and coordinating research on specific targets.

The Director of this Italian Station tells of willing, able assistance and freedom for research

Peter Dohrn

Director, Naples Zoological Station

The Zoological Station at Naples

FOUNDED BY Anton Dohrn in the early 1870's, the Zoological Station has been, and is still, the connecting link between the prodigious wealth of the fauna and flora of the Bay of Naples and scientists from all countries. How is it that an average of a hundred scientists come to the Station every year to work on problems of their own, distributed over the entire range of biological sciences? Why to Naples, when there are so many other marine biological stations in the world?

The answer to these questions seems obvious to the visitors actually working in the Station and aware of the wealth of problems to be attacked here and the possibility of doing so in this setting. For those who do not know the Station, however, it is difficult in limited space to explain why this should be. Nevertheless, some of the essential points can at least be indicated.

Whoever comes to the Station as the occupant of a "table" in order to pursue his own problem, is free from teaching and other responsibilities of his normal environment while being solely responsible for the quality and results of his work. He entrusts himself for the rest to the Station, confident that all technical resources necessary for carrying out his work will be made available to him. These resources range from general advice and, if required, introduction to the literature, to optical equipment; from the provision of chemicals, glassware and special apparatus, etc. to the daily supply of his private aquarium with the necessary living material—so that he does not have to devote time, energy or money to the matter himself.

As a newcomer, the visitor may well at first be shy, and hesitate to make use of the assistance proffered, only to discover suddenly that everything is to be had for the asking, for it is taken as a matter of course by the permanent staff and the assistants that they devote themselves to the visitor. Indeed, in the choice of young staff, the attributes of helpfulness and readiness to identify one's self with the needs of others are rated highly. A candidate for a position on the staff usually spends a probationary year at the Zoological Station, so that he may fully appreciate what his varied duties would be, and so that his capacity to respond to the needs of this environment may be assessed.

Respect and Tradition

In the absence of red tape, the freedom of the visitor is restricted only where the needs and feelings of his fellow guests are concerned. And in this connection it has always been a tradition of the Station that ideological and other prejudices are an unnecessary and unwelcome part of the visitor's luggage. A consistent respect for this tradition in an international community has generated over the years a characteristic atmosphere of rational understanding to which the newcomer responds, almost without exception, so that he himself becomes a bearer of the same tradition. It is not in response to the proverbial beauty of the Neapolitan scene that the visitor comes; it is not solely because of the historic fame of the fauna and flora enshrined forever in the writings of the great nineteenth century biologists; it is not merely because the library in some respects has not its equal in the world; nor is it because facilities available in the Station are not available elsewhere; it is the echo of tradition, heard throughout the world, which brings generation after generation of young scientists to the Naples Zoological Station.

Like every autonomous and self-supporting organism, the Zoological Station is constantly faced with the necessity of procuring that which makes its further existence possible—in this case the necessary funds to meet the requirements of the visiting research workers. This constant effort provides a challenge, such that the institute's powers of resistance and regeneration are repeatedly put to the test, and makes great demand of the staff. The partial dependence of the Station on international sources of income for its maintenance and development necessarily means that it is an organism more sensitive to international

disturbances than any purely state-maintained institution. And on more than one occasion the very existence of the Station has depended on the devoted efforts of sometimes quite humble members of the staff. In eight decades of lively—and at times too lively—existence, by adapting itself to given conditions and sudden demands, the Station has succeeded in maintaining its essential features while developing and widening its range of interests. Its future will follow the same course, so that at all times it shall serve the cause of science to the best of its abilities—even though the precise form of that service may not as yet be foreseeable in detail. To face new tasks as they arise, to deal with them as quickly and as well as one can: this is what is required.

The attempt to meet the demands of many a dozen visitors from all countries constitutes an annual task of considerable and at the time daunting dimensions. This task, however, has the lasting consequence of irresistibly forcing the development of an octogenarian institution in new directions. It submits to a natural law of continuous and appropriate rejuvenescence, as could hardly be guaranteed by any schematic development program, however carefully contrived.

The Budget

The recent budget laid before the Board of Governors shows that the Institute has managed to live on the equivalent of approximately $200,000 during the past year. This sum covered wages and salaries for 57 people; the running expenses of continuously developing laboratories of Zoology, Botany, Physiology, Biochemistry; the needs of the immensely rich library which caters to all biological disciplines and includes over 500 current periodicals; and the wants of the collecting fleet and of the Aquarium. These figures imply that the same sum has to be raised this year if the standard is to be maintained, as indeed it must and will be. It is self-evident that the financial position of the Station would be immensely improved were there available to it an extra fund to mitigate the need for the continuous requests for financial help, while enabling it to retain that freedom and flexibility which the present somewhat hand-to-mouth system assures. The lesson learned during the lean years has been that the will to achieve the purpose, even with restricted means, is more precious than security. And the obligation to serve science in the same spirit as in the past is still the guiding principle of the Station.

The Naples Station

This year it's OKLAHOMA . . .

The 1960 annual AIBS-sponsored meeting of biological societies

will be held at

OKLAHOMA STATE UNIVERSITY

STILLWATER, OKLAHOMA

August 28–September 1

The following Societies have, to date, indicated that they will meet at

Oklahoma State University

American Bryological Society
American Fern Society
American Microscopical Society
American Society for Horticultural Science
American Society of Limnology & Oceanography
American Society of Plant Physiologists
American Society of Plant Taxonomists
American Society of Zoologists
Biometric Society (ENAR)
Botanical Society of America
Ecological Society of America
Genetics Society of America
Mycological Society of America
National Association of Biology Teachers
Nature Conservancy
Society for Industrial Microbiology
Society for the Study of Development and Growth
Society of Protozoologists
Tomato Genetics Cooperative

A report on college-level science courses to challenge the gifted high school student

Edward Frankel
Bronx High School of Science

Advanced Placement Program in Biology

FOR MORE than half a century educators have been aware of the need for special methods in the education of academically gifted students. A variety of devices has been used to meet this challenge. Some educators have favored acceleration, others proposed enrichment. Others, taking a middle position, have suggested a combination of both.

The Advanced Placement Program, which may be classified as both acceleration and enrichment, was initiated in 1952 as the School and College Study of Admission with Advanced Standing. This study was based on the conviction that: 1. students of high ability can and should undertake more intensive and difficult work than they are at present required to take in the later years of high school, and that 2. at least a significant number of secondary schools is likely to be able and willing to make curricular revisions providing enriched courses for such students.

In the Fall of 1953, seven pilot secondary schools, The Bronx High School of Science among them, introduced the Program by establishing college-level courses in certain major subject matter areas for selected groups of very able students. Since this modest beginning, there has been a continuous increase in the number of schools and students participating in the Program. By 1958, 356 secondary schools were offering college-level courses to 3,800 students who entered 300 different colleges in the Fall of that year.

Secondary schools all over the country have evidenced so much interest in the Advanced Placement Program that a description of the experiences with the college-level courses in biology seems in order. These experiences, it is hoped, may be of help to schools interested in setting up similar courses.

At the Bronx High School of Science, the Advanced Placement Course in biology is open to about twenty students selected from the senior class. The course meets for seven periods a week; two double laboratory periods and three single recitation periods. Three additional periods are set aside for student conferences, supplementary laboratory or recitation work, special lectures, seminars, and examinations.

Students are selected for the course from a list of eligible aspirants provided by the Guidance and Program Committee of the school. The teacher interviews all the candidates and makes the final selection on the basis of the following criteria: 1. intellectual and emotional maturity 2. demonstrated superior scholastic ability 3. genuine interest in biology and 4. recommendation of the former teachers and guidance counselor of the individual student.

The Syllabus

The course content is based primarily on the syllabus suggested by the Biology Committee of the Advanced Placement Program.[1] This syllabus is a composite of typical introductory courses as currently taught in many colleges and universities. Fundamental concepts applicable to both plants and animals are selected for emphasis. Evolution is the dominating and integrating theme in which the interrelationships of the organism to its environment are stressed. Functional morphology based upon laboratory experiences with living organisms provides a continuous frame of reference. This fundamental syllabus has been constantly modified in terms of the background, interests, and ability of particular groups of students.

All of our students have taken elementary biology in the tenth year, and chemistry or physics in the eleventh year; all have had three years of mathematics.

On the basis of this common background, it has been possible to work out a curriculum in biology which has a biochemical-biophysical orientation. We have found it possible to present some topics even more extensively and intensively than the Advanced Placement Program requires. The topics receiving special attention are (a) the physico-chemical properties of protoplasm (b) the biochemistry of carbohydrates, fats, proteins, and minerals (c) enzyme study: oxidation-reduction reactions, ATP, hydrogen

[1] The most recent syllabus of the Advanced Placement course in biology appears in the booklet published by the College Entrance Examination Board entitled "Advanced Placement Program Syllabus" 425 W. 117th St., N.Y., 1958, pages 25–31.

transport systems, and the citric acid cycle (d) the structure, function and importance of DNA, and (e) the chemistry of photosynthesis in relation to respiration. The second semester concentrates on concepts relating to evolution. The work is focused on comparisons of morphological and physiological systems in plants and animals: the effect of transition from water to land habitation on body structure, circulation, respiration, excretion, reproduction and the nervous coordination. An integrated unit then presents particular aspects of genetics, embryology, and theories and mechanisms of evolution. This unit also lends itself to the introduction of statistical methods.

Laboratory Work

One of the chief objectives of the laboratory experiences of this course is to familiarize the students with a broad variety of representative plants and animals, in the hope that such a background will contribute to understanding the broad unifying principles of biology and thus produce deeper appreciation of them. The laboratory manual[2] selected for the course presents a study of various types of organisms which are representative of the principal plant and animal phyla. "The emphasis is on the individual organism, and the viewpoint is not primarily structural or taxonomic."

The manual was selected also because it emphasizes direct observations of organisms rather than mere recording of observations in the form of laboratory drawings. Wherever practicable, living organisms instead of preserved specimens are employed. The animals studied include living protozoa, planaria, earthworms, tubifex worms, lobsters, Daphnia, grasshoppers, fruit flies, clams, oysters, frogs, and rats. The plants studied include algae, molds, bacteria, liverworts, mosses, ferns, evergreens, and flowering plants.

Although half the zoology laboratory exercises in the manual are devoted to the study of the frog and the rat, and call for the use of preserved injected specimens, a more accurate and realistic conception of these organisms is also afforded by examining fresh organisms. Our practice is to observe them first alive, then to kill them and dissect them at once for observation of internal structures and internal activities such as peristalsis and heart beat. The dissection of freshly killed pregnant female rats provides excellent material for the study of reproduction. Freshly killed frogs may be used as a source of exciting protozoan and worm parasites as well as of living tissues such as blood, epithelium, and muscle. One should not overlook the gustatory appeal of lobsters, clams, oysters, shrimp, not to mention snails and squids and, for the more daring souls, grasshoppers.

A cardinal principle in planning the laboratory work of the course is to create conditions which enable students to work independently. Each student is provided with individual laboratory specimens and is expected to supply himself with dissection materials, slides, coverglasses, lens paper, and the like. In addition, he receives a complete set of prepared microscope slides for the laboratory exercises each semester. Thus, each student is equipped to work independently and there is little difficulty in permitting him to use the laboratory facilities during his study periods or even to carry on such work at home.

Deciding the sequence of laboratory work is a matter of experience, convenience, and taste. At the Bronx High School of Science, we prefer to study animals in the fall semester and plants in the spring so that we may utilize the spring days for botanical field trips. This arrangement enables us to enrich and motivate the study of botany, an area in which some students tend to exhibit less spontaneous enthusiasm and interest than in zoology. No matter what sequence is followed, planning the work for the entire year at one time is essential so that the delivery of materials—especially of live materials—from commercial suppliers, can be scheduled in advance.

Since it has been impossible in our set-up to synchronize the topics presented in the recitation periods with those considered in the laboratory exercises, the two do not necessarily correspond to any given week. Perhaps this is just as well, since in a sense the two activities represent quite separate disciplines in biology; practice and theory. The divergence of recitation and laboratory topics is not disruptive because there is ample opportunity for coordinating the material covered in laboratory and recitation. Towards the end of the fall semester when the topics being discussed deal with the comparative morphology and physiology of animals, the laboratory work provides the background and factual basis for this unit of work.

Teaching Techniques

Although lecture is traditional at the college level, the teaching methods employed in our course vary considerably, ranging from seminar and round table discussion to simple recitation. The classroom technique most frequently used is discussion based on individual student reports. It is interesting to note that the students prefer this sort of program, perhaps because it offers an opportunity to become more actively and positively involved in the learning process. For the teacher, this method involves considerable preplanning; it entails the preparation of a list of topics for reports, and the references, material and bibliography for each topic. Seminars are conducted periodically to encourage "intellectual initiative and critical responsibility";[3] here the "group-topic" procedure is used. At the beginning of the fall semester, each student is assigned to become class "expert" on one of the organisms studied in the laboratory or on a phylum. He is expected to become thoroughly familiar with the complete morphology and physiology of the organism not only on the basis of his personal laboratory work but also in terms of knowing the specialized literature on the subject. Towards the end of the semester, when the class discussions are centered upon the evolution of various animal or plant systems, each "expert" contributes a discussion of the organism for which he is responsible. For example, the discussion of the evolu-

[2] The manual presently in use is "Manual of Biology" Parts I and II by Douglas Marsland, published by Henry Holt and Co., New York.

[3] The term seminar is here given the definition of R. F. Arragon, in "Education of the Gifted," Fifty-Seventh Yearbook of the National Society for the Study of Education, Part II, University of Chicago Press, 1958, p. 308.

tion of the excretory system consists of a series of reports by the "experts" on the excretory systems of the separate organism. The role of the teacher is to plan and direct the sequence of the reports and to coordinate the discussions.

Term Papers

In the course of the academic year, students are required to read a given number of original scientific papers of current or historical importance. William Harvey's "The Motion of the Heart and Blood" [4] and Gregor Mendel's "Experiments in Plant Hybridization" [5] are read by the students. They then write an evaluation of these papers in the light of their historical importance. An excellent collection of significant historical papers is found in "Great Experiments in Biology" by Gabriel and Fogel [6], which is available in an inexpensive paperback edition. Pertinent articles appearing currently in such popular scientific journals as "Scientific American" are often assigned. Each semester, at least one or two articles have happened to fit in perfectly with our course of study.

In addition to evaluatory papers, each student is required to write a term paper describing a research problem in biology and a proposed experiment. The student is asked to select a specific area of interest and to prepare a digest of significant research in that area for the past five years and to list some of the unsolved problems in the area. The student is required to consult, either by personal contact or by correspondence, a person engaged in research in the area being studied and to find out precisely what experiments are being conducted. Finally, the student selects a specific problem and formulates plans for an experiment which will solve the problem.

Testing Techniques

Since the objective of the course is to present broad basic concepts and principles, testing techniques and instruments must be appropriately broad. In contrast to the present trend toward using objective tests, the most effective instrument for measuring a student's ability to grasp relationships, to make critical evaluations, and to express comparisons, has proved to be the essay question.

Responses are evaluated on the basis not only of content (correctness and relevancy of information) but also of written English (organization, precision of expression, management of emphasis, spelling, punctuation, and sentence structure). At first, students find difficulty in answering essay questions, probably because they have not been accustomed to presenting organized and sustained answers. It is sound and profitable procedure to hold conferences with students about their essays.

The teacher may utilize previous Advanced Placement Examinations as a source of essay questions of the type students should be capable of answering.

Student achievement in the laboratory may be evaluated by the "practicum" administered on an individual or group basis, by requiring written discussions of the laboratory work, by using commercially prepared laboratory test forms, or by grading specific laboratory exercises such as a dissection.

[4] Published by Henry Regnery Co., Chicago, Ill., 1949.
[5] Published by Harvard Press, Cambridge, Mass., 1950.
[6] Published by Prentice-Hall, N.Y., 1955.

Text and Reference Books

A prime requirement for a college-level course in biology is a college textbook. A text that stresses biological principles is preferred to separate texts in zoology and botany. Experience indicates, however, that no one textbook can possibly cover the materials of a course of study in precisely the manner or the sequence proposed by the teacher. Separate supplementary reference books in the following areas are most desirable and helpful: Botany, Zoology, Microbiology, Cytology, Biochemistry, Plant Morphology, Physiology of both plants and animals, Vertebrate Zoology, Invertebrate Zoology, Embryology, Genetics, Evolution, and Ecology. Periodicals and journals are extremely helpful. "Scientific American" is invaluable as a source of current scientific papers.

The Advanced Placement Examination

In May of each school year, the College Entrance Examination Board administers examinations in each of the subject matter areas of the Advanced Placement Program. These examinations are prepared by a committee composed both of secondary school and college teachers. The Biology examination is a three-hour test, of which two hours are devoted to essay questions, and one hour to multiple choice objective questions. Although the examination is open to all students, only those enrolled in the college-level course are required to take it (all students enrolled in the college-level courses at the Bronx High School of Science are required to take the examinations). Examination papers are graded by a marking committee consisting of both secondary school and college teachers. A five point scale is employed in grading: "5" indicates "highest honors", "4" "honors", "3" "creditable", "2" "passing", and "1" "failing". Grades "2" through "5" are then passing college-level grades and should be credited as such.

In July, the colleges receive for each entering student who has completed a college level course and an Advanced Placement examination in the subject, the examination booklet written the previous May, the marking Committee's grade, a copy of the examination question set, and an interpretation of the grades. In addition, the colleges receive a description of the college-level course offered in the secondary school, the grade received in the course, and the secondary school's recommendation. On the basis of the evidence submitted, the college may (a) grant college credit, (b) offer advanced placement, (c) grant both credit and advanced placement, (d) postpone action, or (e) disregard the course and the examination and grant neither credit nor placement.

The reaction of the colleges to the Program is most encouraging. A survey of 360 colleges, conducted by the College Entrance Examination Board in the Spring of 1958, "indicated 150 colleges granting appropriate placement to students who had taken Advanced Place-

ment courses and who had performed creditably on the College Board's Advanced Placement examination. Of the 360 colleges, 210 gave academic credit as well as placement. Some of these 210 colleges, to be sure, placed restrictions on the amount of college credit that could be earned in high school, but most allow credit without limit. Happily, among the earliest and firmest supporters of the Program are many of the outstanding colleges and universities in the country. Of the 150 colleges now giving placement only, without the award of credit, many will surely add the award of credit in a very few years." [7]

Student Performance on the Advanced Placement Biology Examination

The following are the scores received by the students in the college level Biology classes in 1957 and 1958 at the Bronx High School of Science, as compared with the national scores:

ADVANCED PLACEMENT EXAMINATION SCORES IN BIOLOGY FOR 1957 AND 1958 AT THE BRONX HIGH SCHOOL OF SCIENCE AS COMPARED TO THE NATIONAL SCORES

	1958				1957			
	B.H.S.S.		National		B.H.S.S.		National	
Score	No.	%	No.	%	No.	%	No.	%
5	2	9.1	15	7.1	0	0	4	2.7
4	11	50.0	41	19.5	12	70.6	35	23.8
3	7	31.8	72	34.3	5	29.4	56	37.8
2	1	4.5	53	25.2	0	0	37	25.0
1	1	4.5	29	13.8	0	0	16	10.8
	22		210		17		148	

Follow-Up Study

During the school year 1956–57, 74 seniors were enrolled in six college-level courses at the Bronx High School of Science. Of these, seventeen were registered in Biology. In the fall of 1957, Mr. Bernard Manson, Director of Guidance, instituted a follow-up study of the whole group by means of a questionnaire which sought information concerning (a) the extent to which these students had received college credit and/or placement, and (b) their reaction to the Program.

The responses of the seventeen students who had been enrolled in Biology showed that they entered ten different colleges. At these colleges, six had received advanced placement with credit; seven had been granted advanced placement alone; and four had received neither credit nor placement. Of the four, three had not asked for credit or placement, and one had enrolled in a school of engineering where he could not use the credit.

In almost every case, the students answering the questionnaire considered the Advanced Placement courses an asset.

Every student expressed the opinion that the decision to take the college-level courses in high school had been a wise one. Not a single respondent experienced any difficulty as a result of having taken the Placement courses.

The students found that they had developed a new awareness, and an insight into college work. They appreciated the "on-your-own" attitude and experienced real satisfaction.

Evaluation of the Program

Looking back over the past six years, the writer endorses the evaluation of the Advanced Placement Program in Biology by Mr. David A. Dudley, former director of the Program:

"It is of course easy to exaggerate the importance of the Program in which one has been himself directly involved. American education has for many reasons arrived in its history at a moment of self-examination and change. In that process, however, the Advanced Placement Program has been a sound and influential force among the catalysts. The Advanced Placement Program is a fulfillment. And it is also the promise of a new direction in our educational growth. It is imaginative. And it is a re-affirmation of our faith that scholarship is a matter of high consequence." [8]

(The Editor regrets that owing to space limitations a list of recommended text and reference books has been omitted from this article.)

[7] David A. Dudley, "The Advanced Placement Program," *The Bulletin of the National Association of Secondary School Principals*, XLII, (Dec. 1958), p. 3.

[8] Ibid. p. 5.

PHOTOGRAPHERS!

The AIBS Biological Sciences Curriculum Study invites your assistance in supplying new, unpublished, black and white photographs of biological subjects to be used in the books it is designing for the secondary school biology course. Photographs will also be needed for the elementary school program and, possibly, for the pamphlet series now being planned. Your name, address and a complete description should be attached firmly to each photograph. Credit will be given for any picture used, as well as reimbursement according to our rate schedule. Prints will not be returned unless arrangements are made in advance. Address photographs or inquiries to the Director, BSCS, University of Colorado, Boulder.

THE EDITOR'S DESK

The Texas Research Foundation has acquired the herbarium and science library of **Dr. S. F. Blake** (see recent deaths). The herbarium, which was assembled over a fifty-year period contains approximately 35,000 specimens. It is undoubtedly one of the largest and most authoritative private collections in existence of the important plant family compositae.

The International Congress of the Physiological Sciences held in Buenos Aires in August, 1959, provided an opportunity for a number of members of the staff of the University of California at Los Angeles to travel in South America and visit the facilities established there for **brain research.** The visitors were exceedingly impressed by the developments and by the excellently trained, gifted, and enthusiastic scientists. There is adequate building and assignment of research space. The handicaps to research that were noted are mainly financial ones, such as the lack of grants and salaries for full-time work, and insufficient funds for operating expenses and for purchase of equipment.

An extensive exhibit on the **"Ecology of the Redwoods"** has been prepared by the Horticultural, the Conservation, the National Parks, and the Redwood Grove Committees of The Garden Club of America for The New York Botanical Garden. The exhibit will run from January 15 to March 15.

At its meeting on October 12, 1959, **The Board of Foreign Scholarships** approved the report and recommendations of a special committee which it established last June to review the policies, criteria, and procedures used to select American professors and research scholars for **Fulbright Awards.** The committee was composed of representatives of the Board of Foreign Scholarships, the Department of State, and the Conference Board of Associated Research Councils. One of the principal recommendations made by the joint committee was that the Board's policy on "disloyalty" as a factor in considering American candidates for awards under the program be restated to make it clear that this term is used by the Board to denote only activities in violation of law, and that any evidences of such violations that may appear will not be judged by the Board, but will be referred to the appropriate law enforcement agencies, as in the case of any other felonies. It was felt that this clarification would prevent any implication that applicants who are not selected by the Board might be suspected of disloyalty.

On November 13, 1959, the Chamber of Commerce of Racine, Wisconsin, and other friends of J. C. Walker, contributed several thousand dollars to the Wisconsin Alumni Research Foundation to endow a Lectureship in Plant Pathology at the University of Wisconsin. This lectureship will be known as **The John Charles Walker Lectures in Plant Pathology.** Dr. Walker is a past president of the American Phytopathological Society and a past vice-president of the AIBS.

The **"Machris Ennedi Expedition"** of the Los Angeles County Museum, left January 2 for French Equatorial Africa, where it will spend six weeks collecting birds and mammals. Dr. Charles A. McLaughlin, Associate Curator of Mammals at the Museum, and Mr. and Mrs. Maurice Machris, head the expedition.

A supplement to the booklet "Books on Zoology" is now available. It lists 200 zoology books published since June, 1958. The supplement is free and may be obtained from The Society of Systematic Zoology, Department of Zoology, Southern Illinois University, Carbondale, Illinois.

The Cooley Award of $100 was presented to **Kenton L. Chambers,** for his paper "Cytological Evidence on the Relationship of *Krigia* and *Serinia*", the best taxonomy paper at the Annual Meeting of The American Society of Plant Taxonomists. A paper by **Julian A. Miller, J. E. Giddens** and **A. A. Foster,** "A Survey of the Fungi of Forest and Cultivated Soils of Georgia" (*Mycologia* 49:779-808; Nov.-Dec. 1957, but actually published 1958) was selected for the ASPT $500 Cooley Award for the best taxonomic paper concerning southeastern plants published in 1958.

The American Diabetes Association has awarded a grant of $10,000 for the development of a system of abstracting, encoding and machine searching of the diabetes literature. An ADA documentation committee, headed by Dr. Arnold Lazerow of the University of Minnesota is monitoring the project. Mrs. Jessica Melton is principal investigator.

The U. S. Department of Health, Education and Welfare Public Health Service, has awarded 71 grants totaling $1,751,270 for **research in various aspects of aging:** biological, psychological and sociological, as well as clinical problems, including rehabilitation. Four research grants were announced for studies in the **Improvement of Hospital Services and Facilities.** Nine grants have been awarded to support **Community Cancer Demonstration Projects,** ranging in location from Hawaii to Puerto Rico.

Dr. Theodor Rosebury, Professor of Bacteriology in the Washington University School of Dentistry, St. Louis, Missouri, has received a $54,320 grant from the **National Institute of Health,** Bethesda, Maryland. The grant will be used for the first two years of a longtime project entitled "Immunological and other Studies of the Normal Flora."

The report for the third quarter of 1959 of the **Rockefeller Foundation Grants,** lists a total of $1,556,082, of which $546,135 were in the fields of medical and natural sciences.

• At the beginning of a new year, the editor finds on his desk reports from various institutions reviewing their year's progress and future plans:

The Sloan-Kettering Institute for Cancer Research reports the opening of the new Walker Laboratory in Rye, New York in the spring of 1959, with a staff of over 300. The Institute plans to continue its work in three major areas; the solving of practical, immediate problems, extending the frontiers of knowledge in areas in which there is strong evidence that extension will contribute significantly to future ability to control cancer, and developing increasingly accurate methods for empirical testing. The total budget of the Institute now exceeds $7 million.

Resources for the Future, supported by the Ford Foundation, has continued to attempt projects in new or relatively neglected fields, such as outdoor recreation, urban land uses, the economics of forestry. It looks ahead to beginning a critical study of soil conservation programs, to widening the dissemination of the information already collected, to the launching of case studies of particular economic and resource regions, and to extending its program of grants to universities and organizations, among many other projects.

The report of the president of **The Carnegie Institution of Washington** lists research activities in the physical and life sciences in the Geophysical Laboratory, the Department of Terrestrial Magnetism, the Mount Wilson and Palomar Observatories, the Department of Plant Biology, the Department of Embryology, and the Department of Genetics.

• The *BULLETIN* would like to list as many available grants, loans and fellowships as space will allow. If you can supply any information, please address it to The Editor. Some notices follow:

The University of Miami Marine Laboratory announces the availability of financial assistance for graduate (in some cases, undergraduate) students in fisheries and related marine sciences. The John H. Matthews Loan Fund will grant loans of up to $1000. For information, write Dr. C. P. Idyll, Chairman, Department of Marine Sciences, The Marine Laboratory, University of Miami, 1 Rickenbacker Causeway, Virginia Key, Miami 49, Florida.

The University of Toronto invites applications for a research fellowship in parasitology. The $1,800 fellowship is renewable. Inquiries should be addressed to: Dr. A. M. Fallis, Professor of Parasitology, School of Hygiene, University of Toronto, Toronto 5, Canada.

Nominations for the ninth **Kimble Methodology Award,** which gives recognition to the application of scientific knowledge for the public health laboratory, are being accepted until June 1. For information: P. R. Edwards, Chairman, Kimble Award, Communicable Disease Center, P. O. Box 185, Chamblee, Georgia.

March 1 is announced by the **National Science Foundation** as the next closing date for proposals for support of renovation and/or construction of graduate level research Laboratories. Preliminary inquiries should be directed to either The Division of Biological and Medical Sciences or The Division of Mathematical, Physical and Engineering Sciences, National Science Foundation, Washinging 25, D. C.

For information about **Fulbright Postdoctoral Awards,** write to The Conference Board of Associated Research Councils, Committee on International Exchange of Persons, 2101 Constitution Avenue, Washington 25, D. C. 1961-62 awards will include grants for lectures and research in Burma, India, Pakistan, The Philippines, Thailand, Argentina, Brazil, Chile, Colombia, Ecuador and Peru. Applications will be accepted in any field. Candidates for the doctoral degree should apply to the Institute of International Education, 1 East 67th Street, New York City.

Future Biological Meetings and Conferences

The 49th Annual Meeting of **The Poultry Science Association** will be held August 2-5, 1960 at The University of California, Davis. For information, write: C. B. Ryan, Secretary-Treasurer, Texas A & M College, College Station, Texas.

All those interested in forestry, forest conservation and the forest industries are invited to attend **The 5th World Forestry Congress** at the University of Washington, Seattle, August 29–September 10. Approximately 1,500 participants from 55 countries are expected to attend. Inquiries may be addressed to I. T. Haig, Executive Secretary, Organizing Committee, Fifth World Forestry Congress, Department of State, Washington 25, D. C.

The American Society of Mammalogists will meet in Tacoma, Washington, at Pacific Lutheran College, June 19-22. For information about the meeting, write Bryan P. Glass, Department of Zoology, Oklahoma State University, Stillwater, Oklahoma. Two $100 competitive honoraria will be awarded to predoctoral students for the best papers to be read at the meeting. The deadline for submission is April 1. Manuscripts should be sent to S. D. Durrant, University of Utah, Salt Lake City, Utah.

The 1960 **National Microscopy Symposium** will be held at the Del Prado Hotel, Chicago, June 13, 14, 15. Included will be sessions of instrumentation, methods and techniques and applications. The sponsor, Walter C. McCrone Associates, 501 E. 32nd St., Chicago, Illinois should be asked for information.

From March 17 through 20, the 38th General Meeting of **The International Association for Dental Research** will be held at the Morrison Hotel, Chicago, Illinois. For information: Dan Y. Burrill, 311 East Chicago Avenue, Chicago 11, Illinois.

There will be an **International Symposium on Plant and Animal Growth** at Purdue University, June 16 through 18. "Growth Molecule, Cell, and Organism" is the title. For information write: Dr. M. X. Zarrow, Department of Biological Sciences, Life Science Building, Purdue University, Lafayette, Indiana.

A symposium on **The Exploration of Natural Animal Populations** will take place at Durham, England, sponsored by the British Ecological Society, March 28-31. Further information may be obtained from E. D. LeCren, Hon. Sec., The Ferry House, Ambleside, Westmoreland, England.

The 60th Annual Meeting of the Society of American Bacteriologists is announced for May 1–5 at the Bellevue Stratford Hotel, Philadelphia, Pennsylvania. The Executive Secretary, R. W. Sarber, 19875 Mack Avenue, Detroit 36, Michigan, should be contacted for information. More than 450 papers, will be presented. A detailed program will be published by the Society in April.

The VIIth International Anatomical Congress will be held at the Statler-Hilton in New York City from April 11 to 16. Symposia, demonstrations and papers in the areas of gross anatomy, neuroanatomy, embryology, histology, cytology, and tissue ultrastructure will be included. Dr. Don W. Fawcett, Executive Secretary, Department of Anatomy, Harvard Medical, Boston 15, Massachusetts, can supply further information.

The 4th annual meeting of **The Biophysical Society** will be in Philadelphia, February 24-26, at the Sheraton Hotel. Inquiries should be addressed to: Dr. T. H. Wood, Department of Physics, University of Pennsylvania, Philadelphia 4, Pennsylvania.

A **Conference on Algae and Metropolitan Wastes** is scheduled for April 27-29 at the Robert A. Taft Sanitary Engineering Center of the Public Health Service, Cincinnati, Ohio. Papers will be presented in; descriptive statement of the problem, growth characteristics of algae which contribute to bloom development, sources of nutrients, methods of prevention or control, and research needs. For further information: A. F. Bartsch, Assistant Chief for Special Technical Services, at the Center.

The Refrigeration Research Foundation announces a symposium on package environment in refrigerated warehouses at the LaSalle Hotel, LaSalle and Madison Streets, Chicago, Illinois, March 18 and 19. The address of the Foundation is: 12 North Meade Avenue, Colorado Springs, Colorado.

The Association of Southeastern Biologists will hold its Annual meeting April 21-23 at Loyola University, New Orleans, Louisiana. Rev. Father John H. Mullahy, S.J., is Chairman of the Local Committee on Arrangements.

An open conference on **The General Philosophy of Education in Micro-Biology** will be held on Saturday, April 30, at the Adelphia Hotel, Philadelphia, Pennsylvania, preceding the Annual Meeting of the Society of American Bacteriologists.

The Seventh **International Soil Science Congress** will meet at the University of Wisconsin, Madison, August 15-23. The host will be the Soil Science Society of America.

The world's largest professional science teaching organization, the **National Science Teachers Association,** will hold its Eighth Annual Convention in Kansas City, Missouri, March 29-April 2. The theme of the convention is "Current Science and the K-12 Program." The activities will be many and varied, including reports by college and research scientists on recent developments in their fields, and reviews of science programs for all youth. Further information can be obtained from the National Education Association, 1201 16th Street, N. W., Washington 6, D. C.

What Do Biologists Do In The Summer? Here Are A Few Possibilities:

The Tissue Culture Association has announced a summer course in **The Principles and Techniques of Tissue Culture,** to be given at the University of Wisconsin, Madison, from June 20 through July 15. The intensive course is designed specifically for post graduates who plan to use cultured tissues in their research or teaching. Address: Dr. Mary S. Parshley, College of Physicians and Surgeons, 630 West 168th Street, New York 32, New York, not later than April 15th.

The National Science Foundation will sponsor these summer activities:

Institute of Genetics for College Teachers, to be held at North Carolina State College, June 14 to July 21. Further information may be obtained from: Summer Institute of Genetics, Department of Genetics, North Carolina State College, Raleigh, North Carolina.

Institute in Biology, Chemistry and Mathematics for Secondary School Teachers from June 13 through August 5. Refresher work will be offered in botany, chemistry and basic algebra, and all participants will be expected to take work in history and philosophy of science. Obtain application blanks from: Dr. R. G. Smith, Chairman, Department of Mathematics, Kansas State College, Pittsburg, Kansas.

Institute in Techniques and Methods in Field Geology and Field Zoology will be conducted by the Department of Public Instruction of the American Museum of Natural History at the Museum's Southwestern Research Station in Portal, Arizona from July 5 through August 2. Further information may be obtained from: C. Bruce Hunter. Director, Summer Institute in Field Geology and Field Zoology, The American Museum of Natural History, 79th Street and Central Park West, New York 24, New York.

An **Institute in Field Biology for High School Teachers of Biology** will take place during the first six weeks of the summer session at Stephen F. Austin State College. Studies in vertebrate ecology, entomology and field botany will be offered. Write Dr. Alvin Shinn, Assistant Professor of Biology, Stephen F. Austin State College, Nacogdoches, Texas, for information.

Notes on Biologists

Dr. Albert M. Potts was recently appointed Professor of Ophthalmology in the Department of Surgery, as well as Director of Research in Ophthalmology at the University of Chicago. A specialist in toxicology of the eye and in electrophysiology, Dr. Potts was formerly a member of the faculty of Western Reserve University, Cleveland, Ohio.

A leave of absence from the U. S. Army Medical Research and Nutrition Laboratory, Denver, Colorado, has been announced for **Dr. Merrill S. Read.** He is presently a Visiting Professor in the Department of Biochemistry and Nutrition, Virginia Polytechnic Institute, Blacksburg, Virginia.

Dr. Tibor Benedek, editor of "Mycopathologia et Mycologia Applicata," and Associate Clinical Professor of Dermatology, Stritch School of Medicine, Loyola University, was an official guest of the Venezuelan Society of Tuberculosis at its convention, December 8-12, 1959 at Valencia, Venezuela.

On November 21, the outstanding achievement award was presented by the Regents of the University of Michigan to **Dr. Charles W. Shilling,** Deputy Director, Division of Biology and Medicine, U. S. Atomic Energy Commission.

The Narragansett Marine Laboratory of the University of Rhode Island at Kingston, reports the following additions to its staff:

Professor of Biological Oceanography and Dean of the Summer Session, **Dr. Nelson Marshall,** formerly Dean of Liberal Arts at Alfred University.

Dr. Harry P. Jeffries, formerly of Rutgers University, now Associate Oceanographer and Assistant Professor of Biological Oceanography.

Assistant Biological Oceanographer, **Theodore J. Smayda,** who recently returned from four years' graduate study at the University of Oslo, Norway.

Husband and wife, **Dr. James A. Miller** and **Dr. Faith S. Miller,** were honored at the Annual Banquet of the Emory University Chapter of Sigma Xi Honorary Scientific Society on December 8, for their studies on asphyxia of the newborn. They are both members of the Emory Anatomy Department.

Dr. David G. Barry, 1958-59 National Science Foundation Faculty Fellow in History of Science at Harvard University, was appointed Chairman, Department of Biology, Kansas State College, Pittsburg, Kansas.

Recently named Lecturer in Biological Oceanography at Harvard University is **Dr. Bostwick H. Ketchum,** Senior Oceanographer at the Woods Hole, Massachusetts, Oceanographic Institution.

Frederick R. Avis, present Director of the Precollegiate Science Summer Program at the Worcester Foundation for Experimental Biology in Shrewsbury, Massachusetts, was recently honored for outstanding achievements by Brown University, of which he is a graduate.

The New York University Medal was presented on January 6 to **Sir Julian Huxley.** In part, the citation said, "It can safely be said that he has never written a commonplace article. Always he is deeply concerned with man as a steadily evolving creature who strives to reach new levels of life fulfullment."

Dr. Daphne J. Osborne of the Oxford University Agriculture Department, Oxford, England, has been a visiting Fellow in the Biology Department of Princeton University, Princeton, New Jersey. With **Professor William P. Jacobs,** she has been investigating the roles of the "senescence factor", which she discovered, and of auxin in the normal control of the longevity of leaves.

On December 15, 1959, the retirement was announced of **Dr. C. J. Van Slyke,** Deputy Director of the National Institutes of Health. He has made many outstanding contributions to the field

of public health and to medical research administration during his thirty years' service in the Public Health Service Commissioned Corps.

Dr. Herndon Dowling, formerly of the University of Arkansas, has accepted the post of Curator of Reptiles at the New York Zoological Garden—that is, the "Bronx Zoo."

An award for outstanding achievement in research contributing to the advancement of forestry was made to **Francis X. Schumacher** at the 59th Annual Meeting of the Society of American Foresters held in San Francisco, November 18. Professor Schumacher is on the staff of the Duke University School of Forestry, Durham, North Carolina.

Kendall W. King is on a one-year leave of absence from Virginia Polytechnic Institute, and is serving on the staff of the Institute of Nutrition Sciences of Columbia University, which is conducting a Field Project in Human Nutrition in Haiti, in cooperation with the Haitian Public Health Service.

Dr. Harold J. Humm has been appointed the Jacques Loeb Associate in Marine Biology, a Rockefeller Institute Fellowship, to work at the Marine Biological Laboratory, Woods Hole, Massachusetts and at the Rockefeller Institute. He is on leave of absence from the Department of Botany, Duke University.

The appointment of **James W. Moulder** as Chairman of the Department of Microbiology of the University of Chicago, effective July 1, has been announced. He is an authority on chemical mechanisms in the field of infectious diseases, and has been a member of the Chicago faculty since 1944.

From the Societies We Have Reports of the Election of New Officers and New Committees

The Society of Systematic Zoology, at its Annual Meeting with the **AAAS** in Chicago, December 27–30, elected the following: President, W. I. Follett, California Academy of Science. President-elect, R. E. Blackwelder, Southern Illinois University. Secretary, R. T. Abbott, Philadelphia Academy of Science. Treasurer, H. H. Hobbs, University of Virginia. Business Manager of Systematic Zoology, J. M. Savage, University of Southern California. Editor of Systematic Zoology, L. H. Hyman, American Museum of Natural History. Program Chairman, C. F. Lytle, Indiana University.

The Annual Meeting of **The American Society of Plant Taxonomists** in Chicago, December 28–29, elected the following new officers: President, Lyman Benson, Pomona College. Secretary, C. Ritchie Bell, University of North Carolina. Treasurer, Richard W. Pohl, Iowa State University. Chairman of the Council, Mildred E. Mathias, University of California at Los Angeles. New Council Member, Charles B. Heiser, University of Indiana. David D. Keck of the National Science Foundation is the retiring Council Member.

Officers of **The Society of American Bacteriologists,** elected to begin one-year terms on July 1, 1960 are: President, Herald R. Cox, Lederle Laboratories, Pearl River, New York. Vice-President, John E. Blair, Hospital for Joint Diseases, New York City. Re-elected as Secretary and Treasurer were, respectively, E. M. Foster and John Hays Bailey.

Dr. Ira L. Baldwin, Chairman of the Board of Governors of the **American Academy of Microbiology** announced the appointment of two important committees. The first is the Council on Education and Laboratories, with Dr. William Cromartie, University of North Carolina, as Chairman. The Council will encourage the development of new programs of education in various fields of microbiology at those levels where a need exists. The second committee, whose Chairman is Dr. H. O. Halvorson, University of Illinois, is the American Board of Microbiology. The Board will explore the desirability of initiating certifying programs in clinical and public health microbiology and in its several subspecialities.

Charles A. Connaughton, Regional Forester of the California Region of the U. S. Forest Service, headquarters at San Francisco, has been elected President of **The Society of American Foresters** for the two-year term 1960–61. Re-elected as Vice-President is Henry J. Malsberger of the Southern Pulpwood Conservation Association.

Recent Deaths Among Biologists

Sidney Fay Blake, a senior botanist and taxonomist at the agricultural research service in Beltsville, Maryland. Dr. Blake was author of more than 300 natural history publications, and gained world-wide recognition for his botanical accomplishments. December 31, 1959.

Alexander W. Evans, Eaton Professor Emeritus of Botany, Yale University, December 6, 1959.

Arthur C. Baker, a member of The Entomological Society of America, September 11, 1959.

Paul S. Welch, Professor Emeritus of Zoology, The University of Michigan.

Richard B. Miller, Department of Zoology, University of Alberta, Alberta, Canada.

Donald R. Randall, a member of the American Society of Limnology and Oceanography, Akron, Ohio.

T. H. Van Der Honert, Botanical Laboratory, University of Leyden, Holland. 1959.

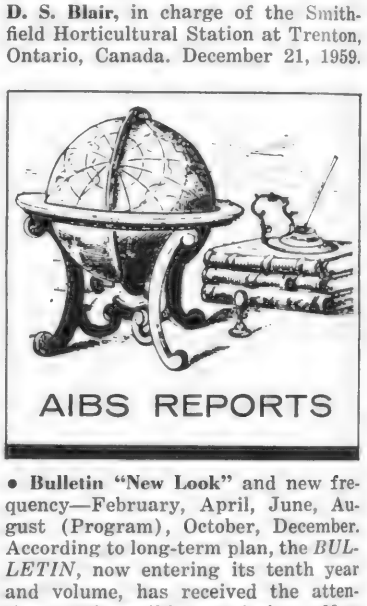
Ivey Foreman Lewis, a member of The Botanical Society of America. 1959.

Robert P. Celarier, Botanical Department, Oklahoma State University. January, 1960.

Margaretha G. Mes, University of Pretoria, Pretoria, South Africa. 1959.

Mrs. Evelyn Palmer, Chicago, Illinois, a member of The Biological Photographic Association, Inc.

D. S. Blair, in charge of the Smithfield Horticultural Station at Trenton, Ontario, Canada. December 21, 1959.



• **Bulletin "New Look"** and new frequency—February, April, June, August (Program), October, December. According to long-term plan, the *BULLETIN,* now entering its tenth year and volume, has received the attentions of the well-known designer Norman W. Och, with the help of Jack Steuerwald. We call your attention to the uncluttered cover, the "AIBS" page, and the new contents page facing it. For some time the eight point Electra has troubled the tired blue eyes of your Director of Publications, as well as a number of our not-so-awfully-young members. The two-column treatment of the feature articles with larger Century Expanded is, we think, an improvement. The new departmental headings are intended to add interest. The ever-helpful counsel of Mr. Willard E. Brown, representing our faithful printer, Judd and Detweiler, Inc., is gratefully acknowledged. We invite your criticism—or approval.

• In the **Russian Translation Program,** AIBS is gradually catching up with Soviet publication of the seven journals involved. Of the several monographs in process, the following are now in print: Origins of Angiospermous Plants and Essays on the Evolutionary Morphology of Plants by A. L. Takhtajan; Problems in the Classification of Antagonists of Actinomycetes, by G. F. Gauze; Trudy-Marine Biology; Arachnida and Arachnoedia, two numbers of Fauna of the USSR. Please bring these important publications to the attention of your library.

• **AIBS Symposium Volumes.** Beside the five books already in print and several contemplated, one is now in process. This is "Leaf Analysis and Fertilizer Problems," sponsored by the American Potash Institute, and Edited by Dr. Walter Reuther of the University of California, Riverside, Department of Horticulture.

• The first meeting of the **AIBS Committee on Translations** met in the AIBS offices December 8, 1959. Dr. Fred R. Cagle, Chairman of the Committee, indicated that though the primary concern would be with translations, the committee must ultimately consider the whole area of difficulty of exchange of biological information between countries where there is a language barrier. Ways of cutting publication costs were discussed, as well as the problem of making the availability of the translations known to interested scientists. The committee hopes to increase the number of biological fields represented by translations, and to interest other scientific groups in discussing and making recommendations about the program.

Members of the committee include: Dr. Donald P. De Sylva, Dr. Foster E. Morhardt, Dr. Kenneth C. Kates, Dr. Wilbur B. Quay, and Dr. Chauncey Leake. Also attending the meeting were Mr. Scott Adams and Mr. Paul Feinstein of the Office of Science Information Service of the National Science Foundation, Dr. Hiden T. Cox, Executive Director of AIBS, Mr. Francis C. Harwood, AIBS Director of Publications, and Mr. Harold Osborne, Director of the Biology News Bureau. The Committee will meet again within the next month.

• The AIBS announced on December 28 the establishment of the **Biology News Bureau** as a new activity to serve biologists and professional organizations in the biological sciences. The bureau is organized as a department of the institute. Its special job will be to fill the urgent need for speeding the dissemination of authentic information about the biological sciences. Harold F. Osborne, formerly a science writer for the *Seattle Times*, editor and correspondent for the *Associated Press*, and on the information staff of the Veterans Administration, has been named Director of the Bureau. Offices will be at AIBS headquarters.

• To keep the biological community, educators, administrators, and other interested persons informed of its plans and progress, **The Biological Sciences Curriculum Study** will issue a series of **Newsletters.** These may contain short articles about particular aspects of the study, announcements of new participating members, descriptions of projects, synopses of research studies and reports of committee deliberations. Dr. Walter Auffenberg, Assistant Director of the BSCS is serving as Editor of the Newsletter. All participants in the study hope that the Newsletter will become an important means of communication with those persons seriously interested in education in the Biological sciences. To be included on the mailing list, address Dr. Auffenberg, Biological Sciences Curriculum Study, University of Colorado, Boulder, Colorado.

• The second issue of **Wildlife Disease** was mailed to over 800 members of the Wildlife Disease Association on December 28. This journal is being produced from typescript in microform only. The current issue was simultaneously produced in three forms; microcards using only one side of card, microcards using both sides of card, and transparent film sheet. Inquiries should be addressed to AIBS publications.

• Last July the **Membership Activities Office** of the AIBS began a complete revision of the name and address lists which it maintains for the 24 Member Societies. The goal was to eliminate all apparent discrepancies between the lists of the various societies and those in the AIBS office. We happily, though modestly, announce that this has been achieved, and that changes submitted by the societies or by the individual members are now processed the day they are received.

• The Publications Office has just completed a catalog of all **AIBS publications.** The catalog will be distributed internationally to public and private libraries.

• **Terry Hunner** and **Joseph Grossman,** AIBS Publications, spent two days in New York calling on prospective advertisers for the *Quarterly Review of Biology.*

• With support of the National Science Foundation, your Director of Publications is conducting a study of the needs of Member and Affiliate Societies in the areas of **Redactory and Business Management Services** to be offered by the AIBS. It is our purpose to relieve the busy scientist of the unrealistic burdens and routine chores of the offices of editor and secretary-treasurer. Although the NSF grant provides only for a study and a report, some 14 societies have evinced interest and three have engaged our services. AIBS Publications invites inquiries from those who may wish to avail themselves of this latest AIBS service to members.

• The proceedings of the **Nonspecific Resistance to Infection Symposium,** sponsored by the Army Medical Corps conducted under the auspices of the AIBS, will be published in the March issue of the *Bacteriological Review.* Copies may be purchased through the Office of the Executive Secretary of the Society of American Bacteriologists, R. W. Sarber, 19875 Mack Avenue, Detroit 36, Michigan.

• **The AIBS Advisory Committee to Lerner Marine Laboratory** met at Bimini, B. W. I., December 9–10. The Research Program at the Laboratory was the subject under discussion.

• The American Institute of Biological Sciences has received a grant in the amount of $50,000 from the National Science Foundation for support of a Program of **Foreign Visiting Lecturers in Biology.**

This program will expand the AIBS Visiting Biologists program to include those distinguished biologists living outside the borders of the United States. The Committee on Education feels that much service can be given to the various disciplines of biology by the presence of these outstanding scientists in the U. S.

The initial program will be undertaken as a small scale operation in view of the logistics involved.

Requests for speakers will be accepted from those institutions which are located in areas reasonably accessible to travelers and which are large enough to provide the facilities necessary for such visitors. A detailed itinerary of the speaker's visit *must* accompany the request.

The initial entry of a foreign speaker into the United States will be for an official AIBS–sponsored visit of four weeks. During this time, the speaker must visit at least *four* institutions spending at least *three* days and preferably *five* days at each school visited.

There will be no geographical limitations as to the origin of the speakers travel. This policy will be followed to the limit of practicability.

Subsistence, air travel, and honoraria will be paid to the speaker for his assigned visit. Institutions will be asked to provide on-campus subsistence as their contribution to the program.

It is hoped that after the completion of his AIBS assignment, other groups interested in the visitor's particular background will utilize his services.

Requests will be received in the AIBS office until April 1, 1960. Immediately thereafter, a committee will meet to review the requests. Notification of the action taken by the committee will be sent to each requesting institution as soon as applicable. Please address all requests to: Foreign Visiting Lecturers Program, American Institute of Biological Sciences, 2000 P Street, N. W., Washington 6, D. C.

ONR Activities

Under the sponsorship of the Office of Naval Research, the AIBS has completed arrangements with Dr. M. R. J. Salton, Department of Bacteriology, University of Manchester, Manchester, England to be **principal speaker** at the **Annual Meeting of the Society of American Bacteriologists.** The meeting will be held in Philadelphia, Pennsylvania, May 1-5, 1960. The subject of Dr. Salton's speech is "The Anatomy of the Bacterial Surface."

Dr. Robert W. Hiatt, Dean and Director of Research of the University of Hawaii has begun the revision of the present **Hydrobiology Directory.** The new Directory will be international in coverage and will include all existing marine and freshwater facilities insofar as possible. Publication is anticipated in December, 1960. This revision is sponsored by the ONR.

A **Conference on Biological Control of Insects of Medical Importance** was held at Walter Reed Hospital, Washington, D. C., February 3-4. This conference was sponsored jointly by ONR, Armed Forces Pest Control Board, AIBS, and the Army Chemical Corps. Because of limited facilities attendance at this conference was by invitation only.

A meeting of the **AIBS Advisory Committee on Hydrobiology to ONR** was held January 15-16, in Berkeley, California. Items vital to the field of aquatic biology were reveiwed and discussed.

Preceding the meetings of the Federation of American Societies for Experimental Biology in Chicago, Illinois on April 11, there will be meetings of two **AIBS to ONR Advisory Committees** on **Physiology** and on **Biochemistry.** Both will meet April 10 to review and evaluate on the basis of their scientific merits, new proposals and currently existing projects.

The **AIBS Advisory Committee on Biology to ONR** met February 12 at the Windsor Park Hotel, Washington, D. C., to review and evaluate research proposals.

The **AIBS Shark Research Committee to ONR** met January 29, in the AIBS conference room.

AEC Activities

The AIBS Advisory Committee on Cancer to the Atomic Energy Commission met in Chicago, December 4-5. The Committee reviewed the Argonne Cancer Research Hospital Program and discussed various aspects of the total Division of Biology and Medicine Cancer Research Program.

A meeting of the **AIBS Advisory Committee on Education and Training to AEC** was held January 27-29 at the Windsor Park Hotel, Washington, D. C. Several AEC representatives attended this meeting, where requests for equipment grants were discussed.

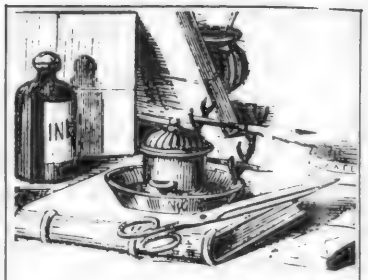
The Cancer Research Program in the Medical Division at ORINS was reviewed by the **AIBS Advisory Committee on Cancer to AEC** on February 1.

AIBS-AEC-NIH — Radiologic Life Shortening and Aging Conference. The Panel Chairmen of the Conference met December 15 at the University of Utah, Salt Lake City. The purpose of the meeting was to update the information regarding subject matter discussed at the last session of the group, and also to consider further activities of the several panels.

The AIBS Placement Service

The largest edition of the AIBS Placement Service Directory yet published is available at a nominal fee of $1.00. The January edition contains resumés of approximately 190 specialized biologists. **Employers** may obtain the Placement Service Directory by writing to the AIBS Placement Service, 2000 P Street, N. W., Washington 6, D. C.

At any time of the year biologists, whether or not members of an AIBS Member or Affiliate Society, or the Institute, can register with the AIBS Placement Service. The Directories are published in January and in June. For further details, please write directly to the above address.



November 27, 1959

I am certain that I am only one of thousands of biologists who get a gruesome feeling when reading the praise of large scale planning in scientific research. The article by Orr E. Reynolds, AIBS Bulletin, Nov., 1959 is only one of many of its kind which have appeared in recent years. I am writing this reply and sincerely hope that it will be printed because if it were not, the impression might be created among readers that we biologists are defenselessly submitting to the continuous pressure exerted upon us which tends to destroy our enthusiasm and our creativeness in an attempt to make us members in teams of specialists. If Reynolds uses the term "democratic" process in the title of his paper, he knows that he only uses it to blind his readers to the fact that he is advocating totalitarian regimentation.

It is a sad truth that certain pieces of scientific work require expensive equipment and the aid of technical personnel. This makes it necessary to beg for money (i. e., "to apply for grants"). These begging actions must be accompanied by research proposals or plans with stated goals, listing also the significance which results might have for the practice of medicine or technology.

Fortunately, most grant-giving agencies permit the investigator to deviate from the original plan; and while the original plan is followed as far as possible by technicians, the senior investigator is thereby permitted to remain his creative self.

While it is possible, and even very slightly profitable, to add little bits of detailed information to an existing body of facts by the planning method, new viewpoints and basic principles of science can only be created in an atmosphere of freedom.

The following is the way in which progress is achieved in science:

An experienced scientist notices an *entirely unexpected* phenomenon (for which planning is impossible, because unexpected observation cannot be planned). He is astonished, perhaps alarmed. The observation may overthrow conceptions which he has held for his entire life. By theoretical thinking he attempts to make the phenomenon jibe with established concepts. He may, then, set up a new speculative hypothesis or a speculative bridge between the observation and established theory.

He then devises methods of new observation to solidify the speculative bridge or hypothesis. This phase involves planning; and frequently, costly equipment and technical personnel are required to carry it out.

If he applies for a grant to test his hypothesis, the application is likely to be turned down, because there is no assurance that the money invested will "pay dividends"; for the goal is speculative. Thus, the investigator looks for a minor side question the pursuit of which might be justifiable on the grounds that it follows lines of conventional thinking. For such a restricted problem he may obtain sufficient funds to enable him to pursue the more important question. But if the scientist is an honest person, he will not obtain funds for the pursuit of a major, new discovery and, at best, he will have to try to carry it out with makeshift equipment investing his own savings.

Now, I come to the problem of interdisciplinary research by teams of specialists. The idea sounds good and makes fine reading when printed on paper. In a few instances, it has produced results. The best known is, of course, the atomic bomb.

In general, such interdisciplinary teams produce little true progress. But they waste much time of the members, time during which each might have done creative, original work.

The answer to team work is better general education, i.e., the education of future scientists in the colleges, emphasis on breadth of vision, postponement of specialization to the level of the graduate school. Interdisciplinary work is becoming more and more important. But it must be carried out by *individuals* with a broad knowledge of all fields of biological, physical and mathematical science on which the proficiency in their own specialty is based.

Our governmental agencies should endeavor to give scientists *more freedom* to follow their intuition, by requiring less planning and by supporting the work of *individual scientists*. They should restrict the awarding of grants to teams or to large organizations.

Hans Elias,
Department of Anatomy,
The Chicago Medical School,
Chicago, Illinois

In order to broaden the scope of the Biology Library Section, we invite scientists interested in reviewing to list their names and special fields with the Editor of the BULLETIN so that appropriate books may be sent to them.

One copy of each publication submitted for listing should be sent to the Editor, AIBS BULLETIN, American Institute of Biological Sciences, 2000 P Street, N.W., Washington 6, D.C. Only books published within a year of receipt will be reviewed. Books marked with a ★ are those published by Bulletin advertisers.

Zoology

Annual Review of Entomology, Volume 4. EDW. A. STEINHAUS, Editor, RAY F. SMITH, Assistant Editor; Annual Reviews, Incorporated, Palo Alto, California; vii + 467 pp. (including bibliography author index, 15 pp. and subject index, 18 pp); 2742 bibliography references; 29 Tables, Charts, Diagrams; 6 black and white photographs (1959) $7.00 USA, $7.50 Foreign.

The most recent addition to an impressive list of Science Reviews, the *Annual Review of Entomology* is already accepted throughout the world as the medium of expression in this field. Following a pre-established pattern of world coverage of subjects and by authors selected by an Editorial Board composed of members of the Entomological Society of America, Volume 4 comprises 19 invitational papers by 23 U. S. and foreign authors and co-authors prominent and currently active in the fields covered. They broadly cover basic technical and economic phases of entomology of most current interest. Each paper reviews world literature to mid-1958 with respect to the history, thinking, action, findings, and progress made and is immediately followed by a comprehensive bibliography.

They review the place of insect blood cells in post emergence growth; relationship of insect tissue to the culture of viruses and production of vaccines; function of pheromones (ectohormones) as sex attractants in insects; techniques used in studying the chemical nature of insect pigments; basic factors involved in separating closely related species; available information on environmental relationship of Cerambycidae throughout the world including physiological and ethological features which may have influenced their evolution and survival; biology of aphids and of parasitic hymenoptera; bioclimatics as limiting factors in insect distribution and abundance useful in forecasting potential spread of pest species into new areas; relative merits of several hypotheses in conducting ethological studies of insect behavior; place of entomophagus insects as mortality agents in terms of host density; possibilities, and hazards involved, in attempting weed control using introduced insect species; comparable patterns of insect control as evidenced by microbial, chemical and parasite-predator methods; value of insect disease as a population mortality factor; present knowledge of "mode of action of insecticides"; biological methods in assaying insecticide residues; seed treatment as a method of insect control, which has been given increased emphasis with the advent of chlorinated hydrocarbons; the historic aspect of fleas as biologic vectors of pathogenes; "insects and the epidemiology of malaria" with two tables, one listing 63 species of known anophelene vectors by country of occurrence, the other showing the status of malaria in 197 countries and territories in which one or more of these vector species occur, recording the 64 countries in which eradication is being conducted and the eight countries in which eradication has been completed. Both tables are helpfully cross indexed, numerically, with corresponding bibliography references.

Every sincere student and research worker in entomology should have a

personal copy of this publication within working reach. While some of the papers are highly technical, many, if not all, merit reading by the layman interested in entomology. *H. M. Armitage.*

Index XVI to the Literature of American Economic Entomology, January 1, 1956-December 31, 1957. Compiled by HELENE G. CUSHMAN, Library, U. S. Department of Agriculture. 8vo., cloth, 694 pp., Washington, D. C. Entomological Society of America, Special Publication 16. (1959) $6.00.

It is always a pleasure to direct attention to the latest issue of this well known bibliographical series, the earlier volumes of which have become more and more widely known. It will be welcomed both in entomological research and in control operations, for the reason that it now completes and brings to date an exceedingly useful reference work that reaches back 99 years and covers American economic literature from 1860 to the present time. It may be remembered that it was the urgency of the need for a work of this kind that prompted the beginning of such compilation by B. Pickman Mann and Samuel Hinshaw, and later continued by Nathan Banks. It consisted of eight volumes and covered the years 1860 to 1905. It was published under the auspices of the U. S. Congress. The 15 volumes subsequent to that period were prepared by Nathan Banks, Mabel Colcord and Ina L. Hawes, assisted at various times by Helene G. Cushman and other interested workers. Beginning with Index VII, it became necessary to enlarge the geographical scope of the series to comprise continental North America, including Canada, Alaska, Mexico, Panama, Canal Zone, Cuba, Puerto Rico, Hawaii, and certain other Pacific Islands, particularly those that played a part in World War II. In all of these, particular attention was given to keeping up with most recent periodical literature dealing with such subjects as the newer insecticides, and the latest approved methods for their application, and, especially, latest results obtained from tests of new compounds. Indeed, so very rapid have been developments along some of these lines that it is of considerable interest merely to note something of the extent to which investigations have been broadened from the previous volume in the use of new words, representing names of new compounds, new subject headings, or new types of equipment. These additions to the vocabulary represent definite milestones in the advancement of our knowledge. Because of the growing multiplicity of cross references to chemicals and their duplication in the various chemical sections of the Index, such references in volumes XIV, XV and XVI have been removed from the text and placed in separate units at the end of the respective volumes with appropriate footnotes to refer the student to such cross reference lists. The compilation of a bibliographical assignment of such wide scope as this entails sustained interest and enormous labor over prolonged periods of time. Grateful thanks on the part of all who use it are due to Mrs. Cushman and her staff for its excellence. On the whole, this book represents an exceedingly helpful addition to a series that is growing in value with each additional volume. *J. S. Wade, U. S. Department of Agriculture.*

★Boy's Book of Turtles and Lizards. PERCY A. MORRIS. 299 pp., illus. The Ronald Press Co., New York, N. Y. (1959) $4.50.

This is a companion volume to two other similarly oriented books by the same author. Geographic ranges, brief descriptions of characters and variable amounts of natural history information are given for a majority of the U. S. species. Not all species of turtles and lizards found in the United States are treated, although the Preface contains the misleading statement that, "This book describes the turtles and lizards to be found in the United States."

In reviewing a book, the reviewer often questions the reason for its publication. For this particular book the answer to this is difficult. For identification and for delineation of range, it cannot compare with the excellent "Field Guide" series. The justification must rest, then, with the natural history observations, which, with the exception of minute points, appear accurately and interestingly written. With some notable exceptions, the reproduction of the photographs is poor. The interjection of subspecific names into some of the discussions is unnecessary and must surely be confusing to the audience for which the book was written. *W. Frank Blair, The University of Texas, Austin, Texas.*

Botany

A California Flora. PHILIP A. MUNZ, in collaboration with DAVID D. KECK. 1,681 pp., col. frontispiece, 134 text figs. The University of California Press, Berkeley. (1959) $11.50.

The need for a one-volume up-to-date manual of the flora of California has been recognized by biologists for the last two decades. This book displaces that by the late Willis L. A. Jepson (1925) and supersedes Munz's *Manual of Southern California Botany* (1935). Botanists have anticipated and awaited the publication of this new volume for many years.

In scope, this Flora treats all vascular plants—the ferns, gymnosperms, and angiosperms. The arrangement of families is a modification of the Bentham and Hooker system of classification—making this the first recent American flora to break from the more widely used Englerian system. Nomenclature for most of the major groups also departs from that used by other authors, *e.g., Lepidophyta* (for lycopsids), *Calamophyta* (for horsetails), *Pterophyta* (for true ferns), *Coniferophyta* (for gymnosperms), and *Anthophyta* (for angiosperms).

Apart from these deviations, the taxonomic approach generally is very conservative, yet reflective of sound contemporary botanical findings (*e.g.,* separation of Paeoniaceae from Ranunculaceae, of Cuscutaceae from Convolvulaceae, and acceptance of the Dandy-Hutchinson circumscriptions of Agavaceae and Amaryllidaceae). The author wisely includes both naturalized and indigenous species in the treatment, and mentions but does not count those species whose reported presence has not been verified by recent documentation. By this reviewer's count, Munz's Flora recognizes 158 families, 1,062 genera, and 5,590 species (as compared with 4,019 species in Jepson's earlier Manual). Diagnostic illustrations are provided for one or more species of each family.

The nomenclature conforms with the current Code, and the author exercises his prerogative of capitalizing binary and ternary epithets where appropriate.

The inclusion of bibliographic citations of recent or major revisions and monographs of a genus is a valuable adjunct. It is unfortunate that the book's designer set the citations in the same type face as is used for the keys and placed them immediately above the first lead of the key, without intervening space. This increases their likelihood of being overlooked. Presence of bibliographic citations does not of necessity mean that the taxonomic concepts of the author cited are necessarily followed in the Flora (*cf.* under *Brodiaea*). On the other hand, the author explains that, to avoid making unnecessary new combinations of names, he has usually adopted the infra-specific categories of an accepted monographic work, thus treating some genera as composed of subspecies and others of varieties.

The keys of every manual provide the core of its utility. Those in this Flora appear to be superior to those of most contemporary works; the key to the included families of the Dicotyledoneae is one of the best examined, although not without its "bugs." (*Cf.* p. 69, Group 2, where a second pair of leads to Euphorbiaceae and Batidaceae have no introductory lead). A most useful innovation is the inclusion of keys to subspecies or varieties after the description of the species concerned (*e.g.*, in *Viola*, *Argemone*, *Astragalus*).

Species descriptions include distribution notes and identify which of 25 California plant communities the species belongs to. These communities are fully described and shown on a map in the Introduction. Wherever known, the haploid chromosome number is given for a species, together with reference to the source of the information.

The professional taxonomist will welcome Keck's meticulously prepared "Abbreviations of Author's Names," notable for its completeness and scholarship, reflected in the accuracy of the entries.

Botanists—students especially—will long be appreciative of the author's effort to have this very large and substantial volume published at a minimal price compatible with good design and utility. Only a University press could do this. This Flora becomes a must for all persons dealing daily or only infrequently with plants of California. *George M. Lawrence, L. H. Bailey, Hortorium, New York State College of Agriculture, Cornell University, New York.*

Ecology

***Principles of Field Biology and Ecology.** ALLEN H. BENTON and WILLIAM E. WERNER, JR. McGraw-Hill Book Co., New York (1959).

The authors define field biology as "the study of life under natural conditions, or in its own environment", and ecology "concerns organisms in relation to their environment" The title of the book thus allows a diverse assortment of information, and the authors have taken advantage of this —a full scope of "field biology" is encompassed. This is well illustrated by the chapter headings, but even these do not reveal the extent of coverage. Of the chapter entitled "Ecological Principles" nearly two-thirds are devoted to description of biomes and discussion of methods. By the end of the chapter, principles seem to be submerged in the details of facts and procedures, but the range of coverage is thereby broadened.

The array of topics is obviously designed to introduce the reader to a considerable breadth of biological endeavors. In the first half of the book, in addition to the chapter on ecology already mentioned, and one on the history of field biology in America, there is a chapter on the principles of taxonomy and two chapters on succession. The last half on which the authors have done a more satisfactory job covers "Economic field biology", "Principles of population study", "Principles of behavior study", "Principles of the use of biological literature" and "The choice and conduct of a field problem". In general, the last part is somewhat better written and will undoubtedly be more effective in holding the interest of students.

In places, one would like to know the information source. Under "Glacial lakes", for example, the familiar kettle hole basin formed as a result of ice block burial by outwash is not mentioned, although scouring and damming are. Also, "When glaciers start melting, large pieces of ice may be left behind, and their weight may form a depression which will eventually become a small lake or pond". Flint in "Glacial geology and the Pleistocene Epoch" doesn't mention the latter method and one would like to know the source of this idea of lake basin formation. The illustrations are not always the most suitable, as for example one captioned "Mammals of the deciduous forest biome" showing a deer with a background of either spruce or fir or both along with some white pine and some white-stemmed trees of paper birch or aspen. While it is true that it is the deer that is being illustrated, it would seem appropriate in this instance to have a deciduous forest in the background. There are occasional apparent misprints and in one place it is difficult to figure out what the sentence was supposed to be or why: "In the headwaters, various flat world there would be no streams, for the water in streams is flowing from an area of higher elevation to an area of lower elevation, and ultimately to the sea." These are examples of things that are likely to be objected to by a critical reader.

As already mentioned, the chapters on economic field biology (forestry, flood control, wildlife management, etc.) population study, and animal behavior are reviews of these fields of science and the student will find them interestingly done. The last chapter, on the choice and conduct of a field problem, is well conceived, quite well presented, and makes a good ending for a text obviously designed for an undergraduate course in general field biology. It is probable that despite certain faults that professional biologists will find, the book may effectively introduce elementary students to the areas of study covered and to the possibilities of field work of various sorts. Particularly in its concluding chapters it may encourage many young people to think in terms of becoming field biologists. *Murray F. Buell, Rutgers University.*

The Ecology of Invasions by Animals and Plants. ELTON, CHARLES S., London Metheun & Co., Ltd. New York, John Wiley & Sons, Inc. 181 pp. (1958).

This interesting and useful book is a very welcome addition to the literature on animal distribution from the viewpoint of an experienced ecologist.

It is provided with an abundance of well chosen illustrations in the form of line drawings and photographs. Perhaps the most unexpected feature of the illustrative material is a reproduction of a life-group picture from Alfred Russel Wallace's "The Geographical Distribution of Animals".

While the book is not a complete compendium of examples of invasions (one will look in vain for a detailed chronology of the history of rabbits in Australia), it contains a great deal of information about the spread of species into previously unoccupied territory. *W. T. Edmondson, Department of Zoology, University of Washington.*

Miscellaneous

***Ultracentrifugation in Biochemistry.** HOWARD K. SCHACHMAN, 272 pp,. illus. Academic Press, New York and London. (1959) $8.80.

This book is an up-to-date monograph on the theory and use of the analytical ultracentrifuge. The author, an outstanding expert, has included detailed sections on the centrifuge, analytical rotors and cells, a review of optical methods, and detailed discussions of sedimentation velocity, sedimentation equilibrium, and the transient states during the approach to sedimentation equilibrium. The large reference section and glossary of terms are valuable. One must agree with the foreword by John T. Edsall that the book will probably become indispensable to laboratory workers interested in ultracentrifugation. *P. A. Shore, National Heart Institute, Bethesda, Md.*

★Principles of Horticulture. ERVIN L. DENISEN. 509 pp., illus. The Macmillian Co., New York, N. Y. (1958) $6.95.

As the author states, this book provides a text which emphasizes for the college student the principles of general horticulture. The skills and practices which make horticulture both an art and science are covered thoroughly. Emphasis is on home plantings—the flower, fruit and vegetable gardens, trees, shrubs and lawns. Commercial production is not covered, yet recent developments such as plastic mulches, and greenhouses, pelleting of seeds, and hybrid seed production are mentioned. Subject matter is exceptionally well illustrated with many original photographs and line drawings.

The text is divided into three parts. The first includes an introduction with chapters on how plants grow, and environmental factors that affect growth. Here the author has occasionally sacrificed accuracy for simplication. For example, a short day plant is defined as one that forms flower buds in 12 hours or less of light, and sweet corn and peas are listed as long day plants which will not flower in winter time in greenhouses without extending the daylength with artificial lights.

The second part covers skills and practices in horticulture. All phases of plant propagation and pruning are included. The third, deals with horticulture for the home. Here the author is to be commended for including chapters not only on fruit and vegetable gardens, and plant materials, but on lawns and hobbies in horticulture.

This book is a text for college courses in general horticulture, and a useful reference manual for the amateur gardener. *S. H. Wiltwey, Dept. of Horticulture, Michigan State University.*

Statistical Methods in Biology. NORMAN T. J. BAILEY. 200 pp. John Wiley and Sons, Inc., New York, (1959) $4.50.

Book reviews often reflect the reviewer's background—his academic and professional training as well as his likes and dislikes. This review is no exception, as my experiences in wildlife biology and statistics during the last ten years have resulted in the opinion that no one statistics book will furnish the needs of, and be readable by, all biologists. During this period I have received numerous requests from biologists, other than agriculturalists, to suggest an adequate statistical text that they could comprehend. Without hesitation I would state that none existed, either because these biologists were mathematically deficient or because current texts were too symbolized, comprehensive, lacked theory or were directed substantially toward the fields of agriculture or medicine. I also hold the view that the fields of sampling, experimental design and analysis are rarely learned by reading a text, especially a cookbook type. Facility in such fields comes from practical experience and understanding statistical theory. While, I do feel that the biologist can learn much from reading certain texts or portions thereof, he should not be lulled into a feeling of "statistical competence" just because he believes he comprehended the material present.

Bailey's text is one of the most readable elementary statistical books that have come to my attention. Possibly this is because it is very limited in scope and contains very little theory. He states that, "The general plan of this book is to show first, in Chapter 2, how statistics can describe and handle whole ranges of variation as opposed to mere averages. Then in Chapter 3 we see how more or less uncertain numbers, like averages calculated from relatively limited samples of data, are related to the 'true' values we should get from extremely large samples. Chapter 4 introduces the basic idea of a statistical significance test which is used to decide whether observed differences between factors are likely to be real or due only to chance. Chapters 5 and 6 then describe a number of the most frequently used significance tests. We next consider, in Chapters 7 and 8, ways of testing whether different groups of data are homogeneous, and whether experimental observations agree sufficiently closely with theoretical values for the theory to be regarded as reasonably adequate. After this the problem of associated measurements is introduced, such as occurs when variations in one quantity, like the length of an organism, is closely connected with variation in another quantity, like the organism's weight. The simple case of a pair of measurements is dealt with in Chapter 9 on correlation and Chapter 10 on regression. More advanced methods of coping with several measurements at once are outlined in Chapter 14.

Chapters 11 and 12 discuss the important questions of how, in specific experiments, it is often possible to choose a pattern of experimentation that is not only highly informative but leads to types of analysis that are simple to perform and interpret. In Chapter 13 we see how to avoid bias in collecting observations or in allocating experimental units, and the final Chapter 15 gives some advice on numerical work and the use of calculating machines."

In addition to the above material he presents a Summary of Statistical Formulae and emphasizes that standard formulae should not be applied blindly. He states ". . . the application of statistical methods requires comparatively little mathematical knowledge or ability. . . . It is of paramount importance to understand the general conditions under which any particular method can be used. Statistical tests should never be applied automatically without first giving some thought to their validity."

I cannot disagree too strongly with his first comment or agree too strongly with his last two and I feel that this book will not provide the biologist with these competences. Bailey does stress various assumptions associated with specific statistical tests. The assumption of independence of the errors is not discussed, possibly because of the difficulty of presenting it in such an elementary treatise. Experience has taught me that this critical assumption is often manhandled by biologists. Bailey follows the commendable procedure of "failing to reject it" and never accepts the null hypothesis. If for only this reason, I would recommend this book to novices in the field of statistics.

The serious student interested in understanding statistical procedures will find this book lacking in statistical theory. However, I do feel that both groups will learn something from this well written book which contains many practical comments. Seriously lacking are examples from the various biological disciplines and there are no literature citations. Discussions of Type I and Type II errors and statistical models of the analysis of variance are omitted. Bailey suggests the procedure of conducting tests of significance of various assumptions and on the basis of these results making a decision as to the test procedure to follow. According to Snedicor this is an incorrect procedure.

With sound statistical advice available to most every biologist through trained statisticians, I feel such advice should be utilized even for what *appear to be* trivial problems. Often, today's "trivial problem" is the statistician's "difficult problem" of tomorrow. I am sure that if the field of statistics is as simple as some authors wish us to believe there would be a surplus of statisticians in this country today. *Vincent Schultz, Division of Biology and Medicine, U. S. Atomic Energy Commission.*

★Canadian Cancer Conference III, R. W. BEGG, Ed. 461 pp., illus. Academic Press, Inc., 111 Fifth Avenue, New York, N. Y. (1959) $12.00.

The Third Canadian Cancer Conference included 28 papers, 25 of which are grouped under three of the most important subjects in cancer research today, nucleic acids, genes, and viruses. The remaining three papers are in a more general section on the biology of cancer. Discussion papers are interspersed with those of a more limited scope. The section on nucleic acids contains nine papers on subjects all of which are important to the cancer field. These range from Hotchkiss' general discussion of deoxyribo nucleic acids as genetic determinants to Stich's interesting paper on growth in the single giant cell *Acetabularia.*

In the section on genetics emphasis is placed on the genetics of transplanted tumors, including the subjects, adaptation of transplantable tumors, chromosomal changes in transplanted tumors and in cells grown *in vitro*, variation and selection in tumor-cell populations, and iso-antigenic systems. In the field of etiology, Gilman presents a short paper on the genetics of induced skin tumors, and Law presents a comprehensive discussion of the etiology of leukemia, a very necessary paper at this time when there appears to be some tendency for certain investigators to be blind to all factors other than viruses in the etiology of leukemia.

The section on viruses is introduced by Luria's discussion of possible linkage between the bacteriophage-bacterium relationship and cancer. This is a very thought-provoking paper and it would have been interesting and worthwhile for it to have been followed by a discussion addressed toward the same subject by someone with long experience in cancer. Lysogeny is discussed in detail by Fuerst who projects his thinking to highly-differentiated organisms. There are three papers on the polyoma virus which merit careful reading for there is much yet to be established and confirmed in this area. Di Carvalho discusses his results from studies of nucleic acid preparations from leukemia in man, revealing thinking based on possible viral etiology. The section also includes a paper on lymphocyte formation in the thymus of the rat, one on thymic lymphocytosis stimulating factor, and one on leukemia and radiation chimera in the mouse. These three are good papers but there is little or no justification for including them in a section on viruses. Omitted from the section are papers on the viral etiology of specific tumors other than leukemia.

In the section on the biology of cancer, Gray presents a general discussion of the biological effects of radiation, and Till and Whitmore describe effects of radiation on cells in tissue culture. The section is concluded with a chapter by Burnet on the biology of cancer that is most highly recommended to the cancer worker. Here, one of our most outstanding investigators in the field of viruses supports the somatic mutation hypothesis and in his short chapter does much to integrate the genetic and viral approaches to the cancer problem. This is a manner of thinking that must be employed in answering the basic questions in cancer. *W. E. Heston, National Cancer Institute, National Institutes of Health, Bethesda, Md.*

Physiological Adaptation. Edited by C. LADD PROSSER. 185 pp. American Physiological Society, 9650 Wisconsin Ave., Washington 14, D. C. (1958) $4.00.

This volume is devoted to the proceedings of a symposium held at Woods Hole, September 5-7, 1957. The symposium was organized in three sessions, the first dealing with temperature adaptation (Kenneth C. Fisher, H. Precht, J. N. R. Grainger); the second with salinity (O. Kinne) enzymes and animal metabolism (W. E. Knox) and physiological adaptations of higher plants (F. W. Went); and the third with enzymes (Novick and McCoy, Maas and Gorini, Magasanik, Niedhardt and Levin). Comments and replies by audience and participants are included, and a summary on the nature of physiological adaptation is contributed by the editor. Although this is physically a small volume, it is set in small type (but with well spaced lines) and is thereby in size and content much meatier than would appear from a casual glance. Each paper is reinforced with abundant references, all of them in the abbreviated physiological style. *Joel W. Hedgpeth, Pacific Marine Station, College of the Pacific.*

Reproductive Physiology. A. V. NALBANDOV. XI + 271 pp., illus. W. H. Freeman and Co., San Francisco, Calif. (1958).

As the author carefully points out, this brief (but well-written) textbook is designed to give a cursory survey of the histology, embryology and anatomy of the reproductive system, in addition to a more detailed coverage of several aspects of reproductive physiology. Moreover, in emphasizing for a wide diversity of student backgrounds, from veterinary medicine to home economics and other agricultural sciences, the role of the endocrine system in reproduction, the author treads lightly and yet quite effectively the difficult path of presenting adequately at the college level a highly complex area of physiology. Introducing the subject with a brief discussion of the "biology of sex", an elementary treatment of the genetics of sex determination and sex ratios, the author proceeds to a discussion of the gross and microscopic anatomy and embryology of the male and female reproductive systems.

The remaining ten chapters of the book are devoted to a skillful intertwining of endocrine function, (with emphasis upon the pituitary gland), and reproductive activities and related phenomena. Such phenomena as breeding rhythms in mammals and birds, pregnancy, lactation and milk production, sterility, castration and other theoretical problems with practical overtones for the agricultural student are included.

Illustrated with clear line-drawings and excellent photographs, this book is an effective treatment of a multitude of ramifications of a highly complex subject with many interesting practical applications. To any student of agricultural science concerned with animal function in general or breeding, nutrition, health and welfare, in particular, this should prove to be an extremely useful reference or text book on the subject of animal reproduction. *Morris Rockstein, Department of Physiology, New York, University College of Medicine*

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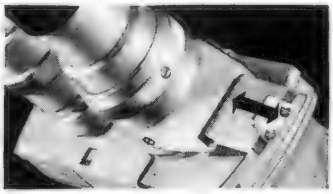

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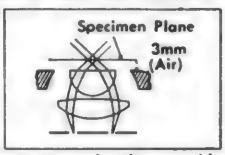

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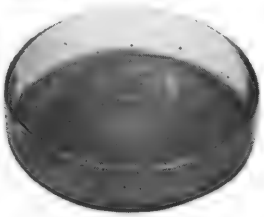

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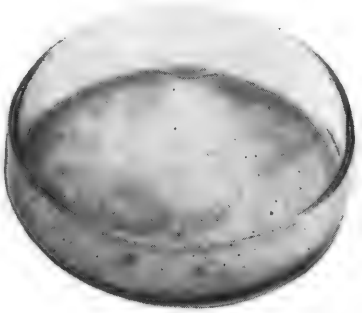

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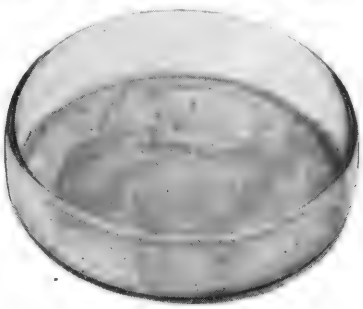

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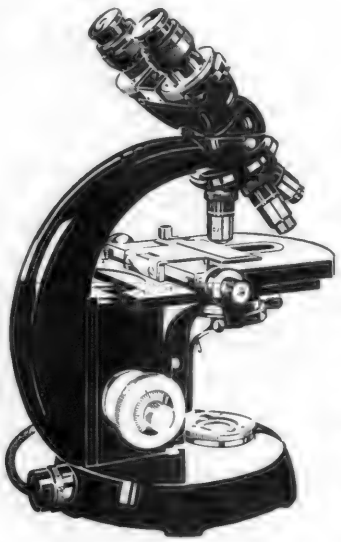

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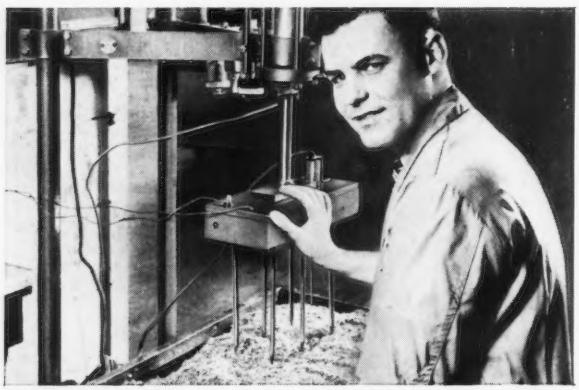
ENTRANCE EXAMS: Tobacco samplings are taken from farms and warehouses, put through exacting tests at American Tobacco's Research Laboratory, even *before* auction time. Result: Fine tobacco—"Sold—American!"

PHYSICAL EXAMS: At the plant, the tobacco is constantly sifted to make sure proper-sized strands are used. These "screen tests" assure better packing and better taste. In addition, samples are taken for laboratory study.



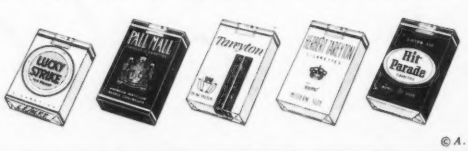
CHEMICAL EXAMS: One of the many tests developed by the Research Laboratory is this "shock test" to measure electrical conductivity of tobacco. Since conductivity varies with moisture content, the test reveals tobacco moisture.

FINAL EXAMS: Not only are cigarettes weighed while being made and reweighed after they are packed, but random packs are rechecked at the laboratory for quality control—and are weighed once again after they have been on the market.

GRADUATES WITH HONORS: One of the many honors earned by American Tobacco in its 55 years of making quality cigarettes is the Distinguished Service Award presented to the Research Laboratory by the Virginia Academy of Science.

The American Tobacco Company

FIRST IN CIGARETTE RESEARCH



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